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[Communicated.]

Coal Gas in Fertilizer Manufacture.

The Improved Equipment Company, of New York, has designed and installed, at Niagara Falls, for the American Cyanamid Company, a coal gas plant of 500,000 cubic feet capacity. The output is to be used in the process of making cyanamid, which is a compounded fertilizer containing atmospheric nitrogen. The carbonizing plant consists of 7 benches of 6's, equipped with Doherty Bench-Fuel Economizers and sectional silica retorts and settings.

Fig. 1 shows the sectional retorts during process of erection and in various stages.

Fig. 2 is the completed operating floor, showing coke conveyor system and coal buggy.

Fig. 3 shows the concrete, outdoor, purifying boxes, and the coils of the Doherty washer-cooler on the outside of the retort house wall. The holder has a capacity of 100,000 cubic feet, but is used only as a relief when the nitrogen ovens do not use the full output of the benches.

Fig. 4 shows the machinery room with the Doherty washer-cooler and pumps for its operation, and other apparatus.

A large quantity of lime is used in making the cyanamid and this is burned in Doherty-Eldred limekilns, equipped with the Eldred process and induced draft.

This new fertilizer is the result of experiments that showed, when nitrogen gas is passed through hot calcium carbide, a compound is produced that is very rich in nitrogen and an efficient means of returning nitrogen to the soil. The American Cyanamid Company has the sole right to make it in this country, and its plant, with the extensions now under way, has a capacity of about 64,000 tons a year.

Fig. 1.

Fig. 2.

Nitrogen is the most important of the plant foods. It is usually the first element to become deficient in cultivated soils, and when good forms and proper amounts are furnished crops respond with more direct and immediate effect than to applications of phosphate and potash. All the combined nitrogen in existence came from the atmosphere at some time. Previous to the discovery of cyanamid the only practical means of directly fixing atmospheric nitrogen was by the action of bacteria. These bacteria, themselves living on plants or plant refuse, take nitrogen from the air and combine it into forms

Fig. 3.

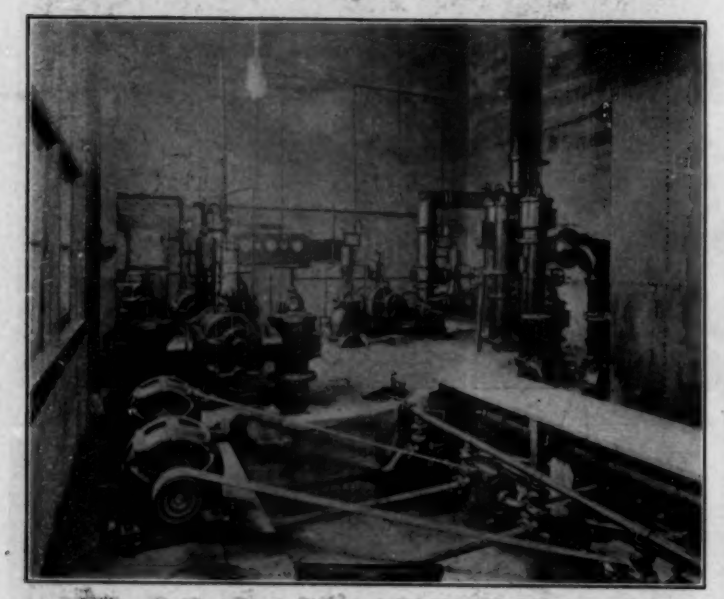

Fig. 4.

that plants can absorb. If plants were not removed, but left to decay where they grew, the fertility of the soil would probably never decrease. When crops are removed, however, the nitrogen is carried away and also the plant matter on which these bacteria feed, so to maintain fertility, it is necessary to restore combined nitrogen to the soil by other means.

Cyanamid nitrogen is readily soluble; as 96 per cent. will dissolve in cold water it is, therefore, available as plant food. On contact with the soil it reacts quickly and forms first the organic compound, urea, then changes into double ammonium compounds. These compounds are not leached or washed out of the soil, but are made available to crops by bacterial action and the solvent effects of plant roots. This action insures a slow, steady supply of nitrogen, not overfeeding crops a few weeks and then starving them, but supplying this element throughout the period of growth. Since the soil duration of cyanamid nitrogen is from 60 to 80 days, crops are not fed when they should be maturing, and, therefore, ripen earlier and more uniformly. Every 100 pounds of cyanamid contains 18 to 20 per cent. ammonia, about 12 per cent. carbon or lampblack, and the equivalent of about 70 pounds of slaked lime, which latter adds considerably to its value as a fertilizer. This lime costs the farmer nothing, cyanamid being sold on the basis of the ammonia content determined by analysis.

The regular application of cynamid to soil will neutralize the acids occurring therein, and the ease with which the lime content of the soil is kept at a desired point makes this fertilizer especially valuable. Many other fertilizers tend to increase soil acidity until finally heavy liming is necessary.

The manufacture of cynamid depends upon the chemical fact that calcium carbide at a high heat combines with atmospheric nitrogen and forms calcium cyanamid. The carbide is placed in ovens, heated by electricity to a white heat and nitrogen is led into the ovens combining with the carbide, forming calcium cyanamid. After cooling, this material is ground, treated with water and put through a mechanical finishing process.

Before the installation of the cyanamid plant at Niagara Falls one matter of importance was to determine the kind of reducing gas to be used, and, after careful consideration, a coal gas plant was decided upon as the output of coke could be used in the manufacture of calcium carbide, and the coal gas gave the greatest amount of carbon content for use in nitrogen ovens. These ovens consist of a series of vertical retorts heated by small individual furnaces. Copper oxide is placed in them and, when brought to the proper temperature, air is forced through, and its oxygen combines with the copper as cupric oxide, leaving the nitrogen free. The air is then shut off, and coal gas passed through the retort, which acts as a revivifier for the reducing agent. The nitrogen is forced through pipes into the electric furnaces to combine with the calcium carbide, forming calcium cyanamid, or commercial cyanamid.

Free Maintenance of All Gas Appliances by the Gas Company.

[Prepared for the February Meeting, New Jersey State Gas Association, by Messrs. J. P. Conroy and J. M. Brock.]

Previous to presenting this paper let it be understood that its authors are not prepared to answer definitely as to the possible expense of the ideas suggested, since the estimating of this expense would be a time-consuming task and require a thorough knowledge of many matters. Neither Mr. Conroy nor myself could possibly spare the time from our regular duties to make an estimate, and, had we the time, we have not the necessary information available from which to gather the figures. We do know, however, and so do you, that there are thousands of appliances now in the hands of consumers that, due to lack of care and attention, are not being used; or, if used at all, are used but little. We know also that where some appliances are used they are giving their owners poor service and, consequently, are serving as poor advertisements for gas and as mighty fine advertisements for our competitors.

Some of you may say, "Why, we do maintain our appliances! We have men to look after matters of this kind. A consumer has but to complain and we immediately send some on to make the necessary adjustment or repairs." This is all very well; but do the customers complain? You may say, "Yes, entirely too much." But you are wrong in this; they do not complain half enough.

If you were to make a complete inspection of all the appliances in your territory, it might surprise you to find thousands which are used but little, and many not at all; and all for the want of some trifling adjustment, which would not take more than a minute or two for a practical man to put in first-class working order.

You would find broiling and baking ovens which are never used, owing to faulty oven burners; top range burners which are never lighted because they smoke; water heaters whose only apparent duty is to occupy kitchen space, since they are never used on account of the odor from a foul burner; gas lamps which are never lighted, because of blackened mantles; and so we might continue, mentioning other appliances, and all idle simply for want of attention from some practical person.

You sell an appliance and consider yourself lucky if your selling expense is no more than 15 to 25 per cent., yes, and in some instances, 50 per cent. of the cost of the appliances; and all for what—simply that at the end of the year your records will show an increase in the number of appliances put out. To show an increase is a commendable ambition; but does the doing of this go far enough? Should you not go a step further and see to it that those appliances give continuous satisfactory service, a service which will prove a delight to the user.

Some of you, when called before your directors to account for a falling off in sales, excuse yourselves on the score that you have reached the saturation point. Well, perhaps you have. We will grant that it is most difficult to find new buyers in your territory, but, if this is a fact, does it not make all the more apparent the need to make greater revenue producers of the appliances already sold?

If you are willing to spend 15, 20 or 50 per cent. of the cost of an

appliance to sell it, can you not well afford to spend a little each year to keep this appliance in perfect working order? Will not the increased earning capacity warrant this expenditure, and isn't it worth the little you may spend to keep your consumers happy and contented? You will get it all back, and more too, in good will and kind words, and these two items are glorious weapons with which to fight competition.

With this much said, let us now see what our competitors and other Public Utilities Companies are doing for their customers. It is known to us that the electric light companies have for years been giving free renewals of all carbon lamps after the first installation, and they are now beginning to give free renewals of tungsten lamps in certain sized units. During the reign of the A. C. enclosed electric arc lamp, and even at this writing, wherever they are in use the electric company in almost every instance has furnished those lamps, installed and maintained them free for the customer. The only stipulation they made in installing them was that the customer must guarantee the use of a certain amount of current per month for each lamp in use; or, in other words, there was a minimum charge on each lamp of say $1 per month.

We are informed by certain electric light interests that all such renewals of lamps used, or service rendered in the care of them, is charged up against the cost of producing the service, the same as the coal used in the power plant or any other item of expense to deliver such service; and the rate was fixed in accordance with the total amount required to produce such service. We learned through a representative of the General Electric Company that there is now a movement on foot to have electric companies furnish free renewals of all tungsten lamps.

We understood that the Public Utilities Commission or the commission of any State having under its jurisdiction the fixing of gas or electric rates, allow the electric companies to charge up against the service the cost of renewals on lamps, as well as the labor and other items of expense attached to the work, as a legitimate charge and the rate on electric current is fixed by them after all such charges have been allowed. Other public service companies are allowed the same privilege, the Telephone Company for instance. It is known that the Telephone Company does not sell the instrument to the consumer, all instruments being owned and entirely controlled and maintained by the company. So exact has the Telephone Company been about the entire supervision of its instruments or appliances, that in most States there has been a law enacted making it a misdemeanor for any person other than employee of the company to disturb the wires or any part of the instruments, in any way other than the mere handling of the instrument for communications. It might be well for us to call your attention here to what telephone service might be were each subscriber required to purchase his own instrument, and allowed to purchase any kind on the market, and then be required to call an electrician or make a special contract for the care and maintenance of each instrument. We understand that the Telephone Company in computing the cost to produce the service is allowed to charge the interest on the investment in instruments (which must be very large) the depreciation on them, cost of maintenance, special complaints and all, even to inspector's time, polishing nickle, and every detail of expense is considered and allowed before the rate is finally fixed by the State commission; and the rate that you are required to pay for 'phone service is enough to take care of every item of expense herein enumerated, together with a fair profit for the company.

The proper adjustment of an incandescent gas lamp, gas stove, water heater or other gas appliance is a far more difficult matter for the ordinary layman or woman than to properly adjust an electric light bulb in the socket, and in many instances might prove more difficult to do than to tighten a loose connection on the telephone instrument; such being the case, why is it not advisable that the gas companies render this service to the consumers. We are aware that representatives of many gas companies will say they have a maintenance department and contract for the care of lamps; but this applies almost entirely to the lighting in business houses; few, if any, have undertaken the inspection and maintenance of lighting appliances in homes.

In the past two years many companies have taken up what is known as home light campaigns, selling single burner lamps in residences on a three months' payment and maintenance plan. If it is advisable to put new lamps on maintenance for the first three months when they are new and should then render their best service, what is to become of such lamps thereafter? We believe the intent of the companies was good, but still if we wished to be critical, we might say these three months' maintenance was placed on the lamp pending the time of payment, and after the company was paid for the lamps they were forgotten and left to the mercy of your inexperienced customers, hoping against hope that they will continue to give service or the customers will educate themselves or employ a plumber to inspect and care for the lamps so that they will continue to give them service equal to that which your brother public service company, electric light company and telephone company render their customers.

The writer of this article spent many years in the gas business, beginning as a meter reader, which affords the opportunity of passing through the kitchens and laundries of private residences, and in many instances have seen gas ranges, water heaters, laundry stoves, etc, out of commission for want of some slight adjustment, such as air mixer, bunsen tubes clogged with dust, range burners clogged by something boiling over on the stove; and in most cases the housewife was at a loss to understand the trouble, but usually resorted to the use of the coal range, apparently fearing to notify the gas company or a plumber on account of the extra bill they might be expected to ask for such service. It would be very interesting were it possible to compile in figures the loss in sales of gas to the gas company each year for want of proper maintenance of all gas appliances. Were it possible to gather such figures accurately it would not surprise us to see that the loss of profit would be enough to pay all the cost of free inspection and maintenance for the year.

We are living in an age of service. People demand service. When you order a bill a goods from the grocer you not only expect him to furnish them, but he must deliver them at your door. The telegraph companies not only transmit your message over their wires, but their messengers will call for it and deliver it at its destination. This is service and all paid for in the rate. The United States Government seems to have responded to the demand of the modern day service by free rural delivery of mail, and it is right; and I am sure you will agree that it requires far more special training or knowledge of mechanics to adjust a gas appliance than it does to carry you your goods from the grocery store, your telegrams to the office or your mail from the post office.

It may be cited that State commissions would not allow the gas company to maintain a free service to all on account of the increased cost to maintain some gas appliances, such as incandescent lamps, over gas stoves, thus giving the user of light a privilege over other users of gas. In view of the fact that we have competition in light, and the draw of the load for light comes at a time when nearly all other appliances are not in use, we should be allowed to make a special rate, providing all users of light in the same quantity were treated alike, just as the electric companies make a special rate on motors or still a better rate on recharging storage batteries.

Whatever might be the objections raised to such a plan by the State commission it would seem that it is up to us to educate them that free inspection and maintenance of all appliances would result in a greater benefit to the consumer than a slight reduction in the price on gas.

There is an unwritten law in many gas companies that their responsibility ceases at the meter, but in this modern day of service it would seem to us this rule might be reversed, the gas company's responsibility to begin at the meter and to end when the gas has been consumed at the burner, giving 100 per cent. service to the consumer.

It is said that a satisfied consumer is the greatest asset that a company can have. If this is true, what a boon it would be to the gas company were all gas appliances under the care of the company. Then they could be reasonably assured that all appliances in use were giving satisfaction to their customers.

The Installation of Cast Iron Mains.[1]

[Prepared for the Eighth Annual Meeting, American Gas Institute, 1913, by WALTON FORSTALL.]

Organization for Work. Small Towns.—The proper organization of a force for the work of main laying will vary according to local conditions, and with the length and size of the main being laid, whether small, (12″ and under) or large, (16″ and over). In any event, the work should be under one man who, whether the superintendent himself or not, will be considered the main foreman, and will be so referred to.

In a small town, or the growing fringe of a large city, the duties of the main foreman shall be quite general. He will make a prior inspection of all locations where work is to be done; plan the work;

1. Slightly abridged.—EDS.

arrange for the delivery of the specials and other material; exercise a general oversight of the work; and inspect the site after completion.

Where the recording of main work is done by the main department, the foreman will make the sketches, assisted by the gang foreman, on portions covered up in his absence.

The composition of individual gangs will depend largely upon local conditions. In the growing fringe of Philadelphia, mostly 6″ in dirt streets, and the average job one block, a good gang is: 1 gang foreman, 2 caulkers, 2 caulkers' helpers, 14 laborers, and, in warm weather, a water boy.

With a competent foreman, a small gang of this kind will turn out a splendid amount of work per man. Each laborer becomes a picked man and is worth the extra pay he gets. If a gang is continually changing in size the output per laborer is appreciably lessened.

Large Cities.—In this case the main foreman's duties will be largely executive, and he must be free at all times to go where needed. He will often have to confer with the officials of other companies when changes of locations of mains, or cases of interference, or damage arise. So much of his time will be taken up that he cannot have very intimate relations with the gang foremen, or lay out their work in detail. He must teach them to decide in ordinary cases. As he cannot follow any daily routine, he should always keep in touch with his office, so that he can be reached quickly if necessary. The gang foreman must be of a higher type than where the main foreman looks after detail. While the latter will have direct charge of the material delivery teams, the gang foreman will determine the material wanted, and its time of delivery. The orders will usually be telephoned to the office for approval by the main foreman, who, because of his knowledge as to the conditions of all his work, is best able to decide upon the details of their execution, and he is often able, by good routing, to decrease considerably the work of the teams. Beside knowing how to handle his men, the gang foreman must have good judgment in ordinary routine work, as for instance, the amount of trench opened ahead of pipe laying, and in meeting peculiar conditions that may arise in the absence of the main foreman. Instant action may be necessary and the gang foreman should be able to act quickly, have a fertile mind, and ability to reason.

Neither the main foreman nor the gang foreman should be expected to make sketches of the work done. To avoid chance of misunderstanding, no job should be done except on a written order from the office accompanied by a sketch giving all information necessary for the work.

The personnel of each main gang will be of a fairly high type, because the obstructions encountered and the heavy street traffic make pipe laying difficult. In Philadelphia a gang comprises, 1 gang foreman, 4 caulkers, 4 caulkers' helpers, 16 laborers.

In tedious or dangerous work, all should be experienced men.

For small jobs of changing mains, where backfilling follows immediately upon laying, such as around manholes, the gang would be 1 gang foreman, 3 caulkers, 2 caulkers' helpers, 1 laborer.

Preliminary Work—Pre-Inspection of Site.—To insure continuity of work, it is necessary to plan ahead, covering a week or ten days. A pre-inscription of each street is essential to ascertain obstructions along the proposed line of main, and at the location given for the trench, sufficient space will be found. Generally, before a permit is asked from the city, or before a route is laid out, test holes are dug to ascertain the exact location of the existing underground structures; the frequency ot the holes depending upon the conditions found. If it is apparent that there is plenty of available space, few test holes will be needed. It is always advisable to do this test work in advance of the trench opening.

Delivery of Material.—The delivery of pipe and specials, must be arranged. Where the force is fairly constant in size, it is easy to estimate the weekly or monthly need for pipe. It may be possible to so place orders that carloads of pipe will be received as wanted, and hauled directly from the car to the street. This makes for great economy in handling.

In stringing the pipe 12″ or larger, it should be left with bells all pointing in the direction in which the main will be laid. Where there is a grade exceeding 5 per cent., the bells should always point up hill, reversing direction at each low point and summit. With smaller pipe it does not pay to add to the expense of loading or unloading by requiring one direction of bells. Pipe should be strung close to the curb and on the side of the trench, except large pipe when the trench is some distance from the curb, and the excavated material will occupy all the space between curb and trench, so that the pipe must be rolled across the street as needed. Where the street open to travel, the pipe must be properly lamped each night.

In addition to the pipe, certain special castings may be delivered on the street prior to beginning work, but it may frequently be more economical to deliver no specials until the exact needs of the job are known.

Blocking, cement, lead, etc., it is a mistake to have on the street in large quantity. Every pound of material left over on a job involves unnecessary hauling expenses. Where cement is used, the more kept on hand the more chance of spoiling by storms. One method of caring for small lots is to pile the bags on the wooden blocks, high enough to avoid wet and then cover with water-tight canvas.

Nature of Equipment.—The normal equipment for a main laying force depends on its size; the character of the work, and jointing material used; and conditions of paving and weather (winter or summer). The equipment listed below can be carried in the service cart (Fig. 1), and will suffice for a force laying 4″, 6″ or 8″ pipe.

Fig. 1.—Service Cart.

1	Asphyxiation kit.	1	Pipe, smelling.
2	Bags, 4″, 6″ and 8″.	1	Pair pliers, gas.
1	Bar, leak.	2	Porters.
1	Bar, rock pinch.	2	Plugs, wooden, 4″, 6″ and 8″.
1	Bar, search.	1	Pump, bag.
2	Bars, tunneling.	5	Rammers.
1	Brush, pipe, 4″, 6″ and 8″.	6	Rods, canvas screen.
1	Bucket, galvanized iron.	1	6′ rule.
6	Chisels, cape.	3	Screens, canvas.
6	Chisels, dog.	2	Shovels, flat nose, "D" handle.
8	Crowbars.	13	Shovels, sharp nose, "D" handle.
1	Cup, drinking.		
12	Cutters, asphalt.	1	Shovel, sharp nose, straight handle.
12	Diamond points.		
	Fittings and nipples, assorted.	15	Signs, danger.
2	Forks, bag.		Soap and brush.
1	Gauge, syphon.	2	Stoppers, 4″, 6″ and 8″.
2	Hammers, 14-lb. sledge.		Tallowcloth.
1	Hand saw, crosscut.	1	50′ tape, canvas.
10	Lanterns, red.	1	Tapping machine, with drills.
10	Lantern rods (unless danger signs are used).	2	Targets, ditch (either type).
		3	Sets of tools, caulking.
1	Level, small pocket.	2	Wedges, asphalt.
1	Level, 24″.	6	Wedges, concrete.
300′	Line, ditch.	6	Wedges, frost.
1	Mattock.	3	Wedges, pipe bursting.
1	Oil can, squirt.	1	Wrench, plug.
15	Picks.	2	Wrenches, trimo, 14″
15	Pick handles.	10	Pounds yarn.
5	Pins, ditch line.		

For Cement Joints.		*For Lead Joints.*	
1	Board, mixing.	3	Bands, pouring, 4″, 6″ and 8″.
1	Bag cement.	1	Bellows.
3	Prs. gloves, rubber.	1	Furnace, lead.
1	Sieve, cement, 12″.	1	Ladle, pouring.
1	Trowel.	25	Pounds lead.

When pre-inspecting the site, the location of service carts, tool boxes (Fig. 2), tool wagons (Fig. 3), is usually determined. When there is much equipment a vacant lot is preferable to roadway location. Ordinarily, a suitable location is in the roadway of an intersecting street at an end of one-block job, or near the center of a larger job.

Preparing for Trench.—The occasional necessity for line and grade stakes has been mentioned. It is always well to give the surveyor at least a week's notice. When there are no curbs at either side of the street, or at the intersections, stakes are needed. If either side, or intersection, has curb set, obtain from the surveyor the width of street, whether straight grade through the block, and the location

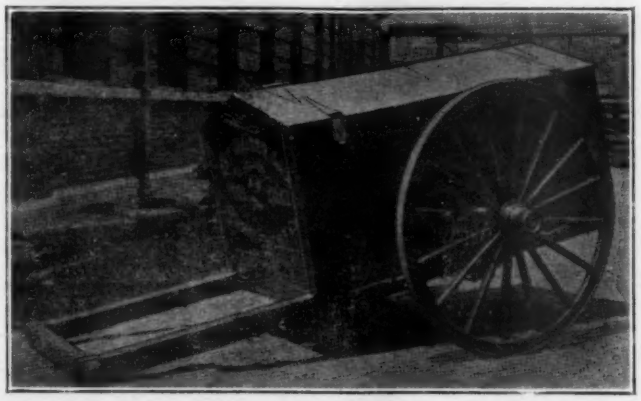

Fig. 2.—Tool Box.

Fig. 3.—Tool Wagon.

and height of the summit, then by means of tape line, level board, tees and targets, the height of curb and proper depth of trench can be determined accurately enough.

The trench is then marked out, the width required being as follows:

Size.....	4″	6″	8″	12″	16″	20″	24″	30″
Width....	18″	18″	18″	22″	26″	30″	36″	42″

If the street is paved, both sides of the trench are marked with colored crayon.

The pipe is also lined up on the opposite side of the trench to the proposed excavated material. This ordinarily will be on the side nearest the curb. The bells should be pointed in the right direction, the pipe overlapping as nearly as possible the exact depth of joint. The larger the pipe and the longer the stretch lined at any one time, the more will be the saving by careful lining. On large mains, where the earth is thrown on the curb side, and the pipe strung across the street, it may not be advisable to line the pipe, but simply to roll it across as needed.

Removing Paving.—Separating Material.—On a paved street there are usually several classes of materials to remove, and each class should be kept separate. Asphalt pieces, or paving blocks, are generally piled, often forming a retaining wall for earth excavated. Bricks or rectangular stone blocks are often of use in making channels for conducting water flow under excavated material. Sand or concrete should be kept free from earth.

In the case of a small main, the earth would be thrown on one side, the paving material and base on the other, and they may be allowed to lay where they fell, not being in sufficient quantity to interfere with laying operations. If gravel, or sand, is encountered, and if it is of value for repaving or other use, it is kept separate. Where there is rock, the pieces are generally thrown clear of the earth excavation, so they can be hauled away.

Asphalt.—In cutting asphalt, the screen, Fig. 4, should be used where there is any danger of injury from flying chips. As a rule the

Fig. 4.—Asphalt Screen.

side towards the footway need be screened, but if near a car track with much traffic, and open cars are in use, the track side will need a screen. Support for the screen is obtained by the device shown, or by tying to trees or poles.

Each cut is made by two men working together, using asphalt cutter A, Fig. 5, one cutting right, the other left, the line marking the side of the trench being the center of the cut. The pairs of cutters are spaced eight feet apart, the first pair cutting the right hand line, and the second the left hand line.

After all the cutting is finished, a man sweeps up all the chips inside the screen, and any that may have passed over. If, on a concrete base, with both sides cut through to the base, the asphalt can be lifted off with bars, *D*, Fig. 5; each lifting gang being of 4 men,

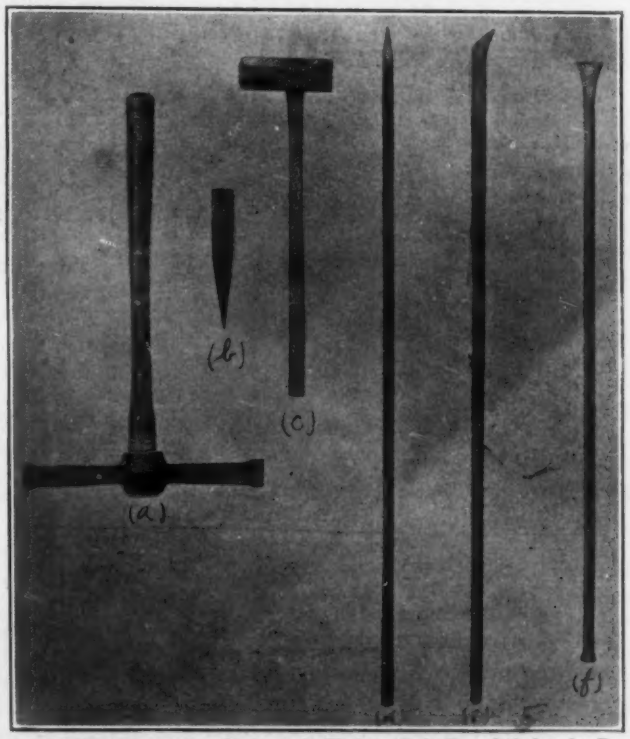

Fig. 5.—(*A*) Asphalt Cutter, (*B*) Asphalt Wedge, (*C*) 14 Pound Sledge for Breaking Asphalt, (*D*) Bars for Lifting Asphalt, (*E*) Curb Lever, (*F*) Iron Tunnelling Bars.

2 using the bars, one breaking the asphalt with the sledge, *C*, and 1 man carrying away the pieces. As many gangs may be set to work as the width or length of trench will allow.

If on a rock or bituminous base it is removed as follows: Asphalt wedges, *B*, are driven in at the bottom of the cut towards the center of the trench, at an angle of 45° with the paving. Four wedges, all on one side, about 12 to 15 inches apart, are used at one time, driven in 6 inches, and then loosened by hitting down on the upward face of the wedge. At the same time the asphalt is sledged on top at about the centre of the trench. Then the wedges are withdrawn, bars put in the holes and the asphalt raised. On trench for small pipe, all the asphalt can ordinarily be thus raised from one side. On wider trenches, the same procedure of wedging and sledging must be followed on the other side. It is often advisable to begin to wedge up another section of asphalt before raising all the asphalt that has been

loosened. By leaving in the last wedge, a better purchase is obtained on the next section. The gang is of 6 men, 3 on the sledges and wedges, one alternating between the bar and the sledge, and two moving the asphalt pieces.

On a bituminous base, where the distance between cuts is over 30 inches, the curb lever, *E*, may be used to better advantage than the regular bar, *D*, for lifting the asphalt after it has been loosened.

The asphalt, loosened, is broken up with sledges and piled on the footway along the curb, in heaps about 2 by 4 by 3 feet high, 12 feet apart.

Other Paving.—Where there is vitrified brick, belgian block, asphalt block, rubble, cobble, or macadam paving, instead of marking the trench by crayon, an alternative method is to drive ditch line pins 100 feet apart. Enough paving is removed to make room for the pins, which are driven in an angle of 45° into the paving, pointing out from the trench until the head of the pin is almost flush with the paving, so they will not become loose as exavation proceeds. A line is stretched from pin to pin, as a guide for paving removal and exavating. For vitrified brick, belgian block and asphalt block, the removing gang is composed of one man barring out paving with the all iron tunneling bar, F, one standing in the trench, lifting the blocks and throwing them towards the curb, and one man piling. For these and for asphalt, it is best to remove paving by a special gang, and keep well ahead of the trenching. For rubble, cobble or macadam, the trench is laid out in 12 foot sections, and each man removes his own paving with pick and shovel, throwing it out of the trench, additional moving and piling being done by separate men.

Trenching—Preliminary Work.—Preliminary to, and during the opening of any trench, certain precautions are necessary for the protection of the public, of the workman, and of the trench.

Roadway traffic and footway across the trench, may have to be provided for. A footway bridge in its simplest form will be 2 or 3 planks laid across the trench, battened together, with a plank on each side as a guard.

Where important streets are opened, the footway should be at least 3 feet wide and have sides 3 to 4 feet high. Attention must be paid to each end to prevent stumbling.

Roadway bridges should be of 3″ planking on crosspieces about 2 feet apart, projecting 2 feet into each bank. They should not be less than 8 feet wide, between the guard rails, the floor level with the top of the paving.

A trench for large pipe, or any trench paralleling a car track, the exavated material being on the curb side, should have a guard rail along the exposed side. This can be made by using short pieces of 6″ x 6″, or 8″ x 8″, about 12 feet apart, to each of which a 1″ x 6″, 3 feet long is nailed at a post, and a 1″ x 3″, nailed to the top of these posts, as a top rail.

In excavating under car tracks, the paving between the rails, and 1 foot outside should be removed and 3″ plank laid parallel to the rails, and extending 2 feet into the bank on each side. The planks should be flush with the rail and well secured.

In providing bridges and other steps necessary to minimize inconvenience to the public, niggardliness is apt to be poor policy; and proper appreciation and provision for the rights of the public are quite compatible with economical operation.

The requirement for access to fire hydrants will vary in different places, but excavated material should be kept at least six feet from a hydrant, and access to it, night and day, provided, even if it means a bridge across the trench.

At night the trench and all material should be protected by red lanterns.

Protection of the Workman.—The danger from a cave-in is generally absent in gas main work, because of the shallow trenches. If, because of deep excavations or unstable material, there is any question of the stability of the trench sides, the matter of shoring should receive careful attention. Usually a stretcher of 2″ x 12″, sixteen feet long, in one or two lines, held by adjustable braces (Fig. 6), will suffice. Where sheet piling is required, 1″ x 12″ boards may be placed back of two lines of stretchers. Naturally, where shoring is resorted to, undue weight should be kept from the trench side, and this may mean the second handling of material.

Protection of the Trench.—Provision should be made to prevent surface drainage flowing into the trench. No duty of the gang foreman is more important than to have his trench protected from the results of rain storms. If underground water flows into the trench, a sump hole should be made, and a pump, of either type in Fig. 7, used.

Fig. 6.—Adjustable Braces for Shoring.

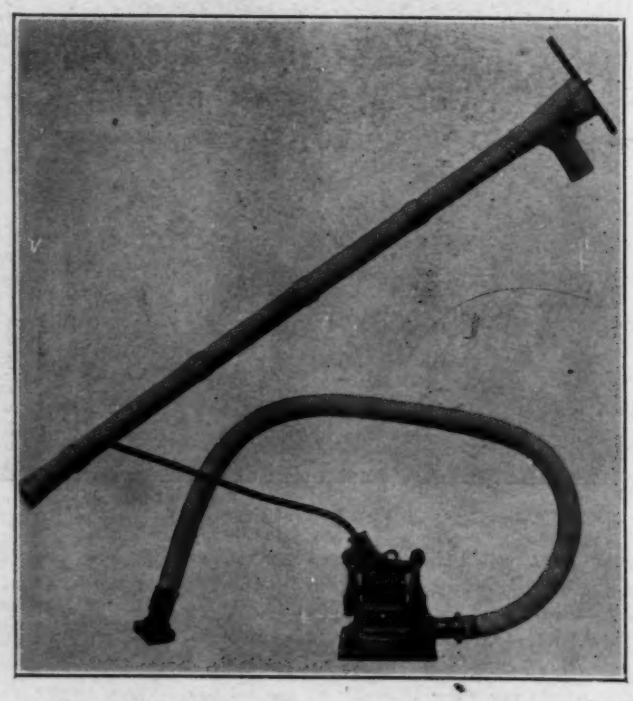

Fig. 7.—Pumps for Removing Water from Main Ditch.

Under this head may be considered the necessity for marking at the trench side, the probable location of any water services crossing. In each case the laborer should be shown the mark, and cautioned to be on the lookout for the service, in order to avoid injuring it.

Earth Excavations.—For small mains, the ditch lines and pins mark the side of the trench opposite to the excavated material. Each man is assigned 12 feet for his work. This sectioning affords an easy way of comparing the relative efficiency of laborers. In each gang, it is advisable to have one or two men better paid than the rest, to serve as pace makers. If conditions are alike, the gang foreman expects all the sections to go down equally fast, and this pitting of each man against his fellows conduces to high efficiency. The men take pride in finishing first, and the laggards are teased.

For large mains, both sides of the trench are marked by a line. For mains up to 16″, the diggers are expected to throw the material far enough to render subsequent trimming unnecessary. For 20″ and 24″, diggers are placed 8 feet apart, and for 30″, six feet apart. For 20″ and 24″, no trimming is done until the excavation has been completed. For 30″, at a depth of 4 feet, it is necessary to place one man on the bank to trim the material thrown out by two diggers.

On every job, special men, the caulkers or pipe layers, are assigned to open over the mains to which connection will be made, and over any places where obstructions are expected, that may affect the depth of the trench, and which therefore must be known before bottoming.

After the depth of trench has been decided, the ditch targets, Fig. 8 Fig. 9, are placed in position. When working in frozen ground, one or more holes should be made through the frost, and then by us-

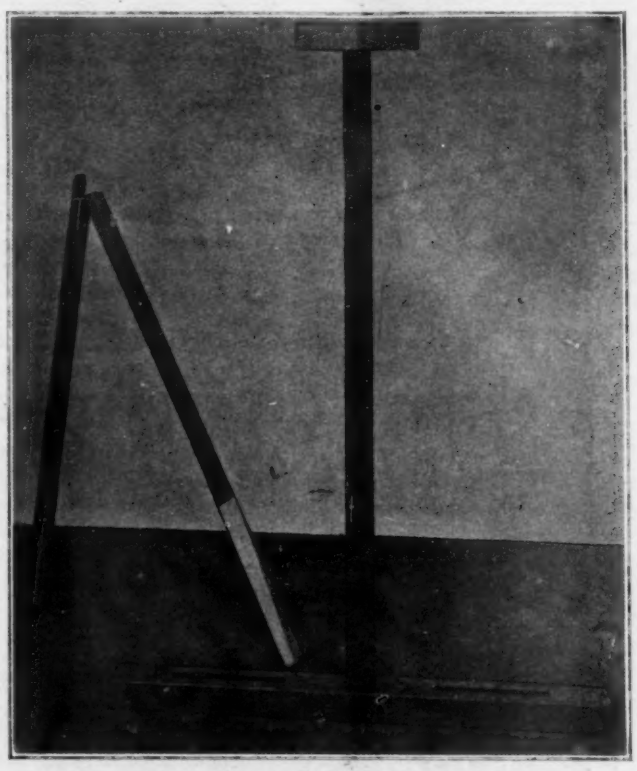

Fig. 8.—Ditch Target.

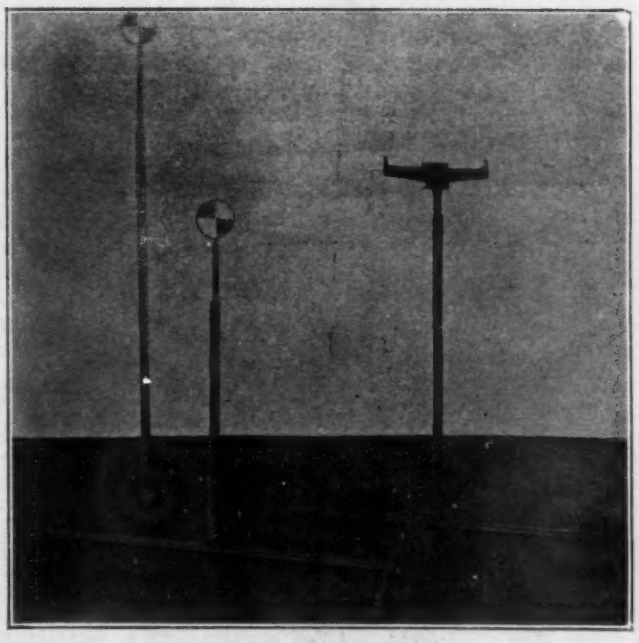

Fig. 9.—Ditch Target.

ing the frost wedges, *C*, Fig. 10, and barring off from the face thus made, the frozen ground can be lifted like a concrete base.

Rock Excavation.—Where blasting is not necessary, and the rock may be removed by bars, *A* (Fig. 10), wedges, *D*, and sledges, *B*, the men work in pairs. The small spalls are thrown with the dirt on the opposite side of the trench frome the large stone.

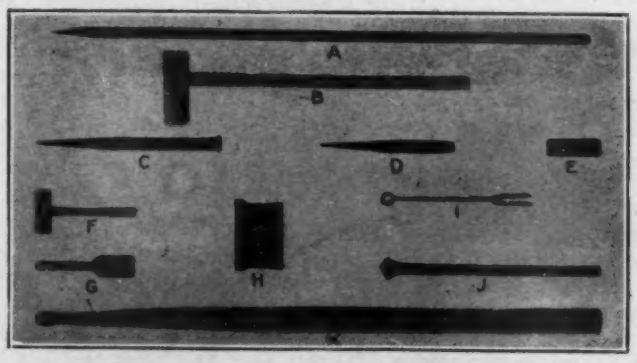

Fig. 10.—(*A*) Bar for Removing Rock. (*B*) Sledge. (*C*) Frost Wedge. (*D*) Wedge for Removing Rock. (*E*) Bursting Wedge. (*F*) Caulking Hammer. (*G*) Cement Caulking Tool. (*H*) Wire Brush for Cleaning Cast Iron Pipe. (*I*) Bag Fork. (*J*) Drill Used in Blasting. (*K*) Porter.

Where blasting is required, 3 men form a gang, and the gangs work as close together as possible. One man holds the drill, *J* (Fig. 10), and two men strike. The charging, covering and firing of the holes should be delegated to one experienced rock man. Upon his judgment will depend the placing of the holes and the charges used. In general, the attempt is always to secure a face extending the full depth of the proposed trench. By staggering the holes in the various rows, the best progress is made. Where the rock is very hard for small mains it is advisable to start with a width of trench twice that for earth. This will allow for failure to blow out to complete width in places. All firing should be done from a battery, and great care must be taken that all workmen and the public are at a safe distance before firing.

There should be a space of at least 4" between any solid rock left in the trench and the nearest point of the main as it rests on its blocking. This is necessary to minimize the chance of future breaks or leaks from blasting operations when laying other structures.

(To be Continued.)

Address of Mr. Alfred S. Cooke, President, the Indiana Gas Association, Sixth Meeting, Terre Haute, March 11 and 12.

Mr. Chairman and Members of the Indiana Gas Association: With the inauguration of this meeting there comes the closing of another year's history of the Indiana Gas Association, one that will forever be important in its annals owing to the inception of State control of public utilities through a Public Service Commission.

While it is customary at this time to dwell somewhat on matters pertaining to the gas industry, to the Association, its aims and accomplishments, it is thought advisable to devote this address to the subject of "Co-operation" as one of vital importance.

It is, perhaps, superfluous to call attention to the changed conditions experienced in the past few years with reference to the relations of the general public and large corporate interests; but this change must necessarily be recognized in the consideration of the subject in hand. The change in governmental and State policy, the consequent unsettled condition of the public mind, the appointment of commissions to exercise supervisional control over public utilities and large combinations in the industrial field, pointedly demonstrate the existence of some undefined deviation from conditions that must be remembered and brought again into harmony before normal conditions and public confidence can be restored.

Without doubt many can prescribe a remedy, but the remedial agencies recommended are so variable in character and operation, no reasonable hope can be entertained that any self appointed Moses will be able off hand to discover the way and lead us out of this wilderness of turmoil, accusation and acrimony into the promised land.

While the individual is powerless it becomes the duty of associated individuals to assume the task of clarifying the situation, and, with their assumption of the burden, co-operation not only becomes necessary but is of the utmost importance.

While it would at first sight appear that the placing of control over our industry was scanty recognition of our rights in view of the immense amount of pioneer work done, and of the devotion of thought, energy and capital toward the perfection of service, is it not possible that control, being of a co-operative character, is the feature that will soonest bring permanence to conditions acceptable to all concerned? Will not this control dissipate that friction which creates trouble? If our principles are true should we fear such co-operation? Will not co-operation in a large measure bring about that which we have so long striven for? Will it not clear the atmosphere of all setiment inimical to our interests, and permit us to conduct our affairs secure in the knowledge that results of our labor will receive approbation from those we serve? We firmly believe it will.

Much of present day antagonism is hereditary and but little diminished in transmission, and it is unjust that present practice should suffer ill repute because of conditions in past times when methods were crude and far removed from the efficient methods of to-day. A marked change, due to education, research and hard work, is now resulting in a product of increased value at a reduced cost, and in an

(*Continued on page* 170.)

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NOTICE TO ADVERTISERS.

New Advertisements and changes of copy therefor should be in hand Wednesday noon of week prior to date of issue.

NEW YORK, MONDAY, MARCH 16, 1914.

[Official Notice.]

Tenth Annual Meeting, Illinois Gas Association.

Illinois Gas Association,
Office of the Secretary,
115 North Oak Park Ave.,
Oak Park, Ills., Feb. 21, 1914.

To the Members, Illinois Gas Association: The Tenth Annual Convention, the Illinois Gas Association, will be held in Chicago, March 18th and 19th, 1914, at La Salle Hotel. The following papers are included in the programme:

"The Welding and Cutting of Metals in the Gas Industry," by W. P. Harding.

"Trenching Machines Versus Hand Digging," by C. B. Strohn.

"Utilization of Gas Appliances in the Wholesale Preparation of Food," by I. A. Hoy.

"Street Lighting by Gas," by F. V. Westermaier.

"Applications of Centrifugal Machinery for Boosting and Exhausting," by E. A. Hultz.

"Modern Coal Gas Practice," by W. E. Hartman.

"The Process of Manufacture of Gas Stoves and Ranges, from the Raw Materials to the Finished Products."

"The Process of Manufacture of Pipe, from the Raw Materials to the Finished Products."

The banquet will be held, in the Red Room of La Salle Hotel, the evening of 18th. To be of the modern stag style, with prominent speakers and vaudeville acts.

Copies of the papers and the programme will be mailed to the members on March 10th. Horace H. Clark, Secy.

[Official Notice.]

Sixth Annual Convention, Pennsylvania Gas Association.

Pennsylvania Gas Association,
Office, the Secretary, West Chester, Pa.,
Feb. 23d, 1914.

To the Members, the Pennsylvania Gas Association: The Sixth Annual Convention, the Pennsylvania Gas Association, will be held in Allentown, Wednesday, Thursday and Friday, April 8th, 9th and 10th, 1914. The headquarters will be in the Hotel Allen. A list of the other hotels will be mailed. Early reservations are requested so that every member attending may be properly accommodated. Papers on the following subjects are promised:

"Improving Operating Conditions for Small Works."
"Office Practice."
"New Business Methods."

There will also be a number of topics up for discussion, and in order to give sufficient time to the more important subjects each member is asked to submit such subjects as he may be interested in, and the topics receiving the greatest number of requests will be considered.

All requests should be forwarded to Mr. G. S. Speaker, Lebanon, Pa.

The entertainment arranged provides for this;

Tuesday night: Informal Dutch supper.
Wednesday night: Theater.
Thursday afternoon: Open.
Thursday night: Banquet.

The Secretary requests that the postal card enclosed with each member's preliminary notification be returned at once to Mr. Crankshaw, to the end that the work of the Committee may be successfully carried out. W. O. Lamson, Jr., Secy.

[Special Editorial Correspondence, by Telegraph.]

ANNUAL MEETING, INDIANA GAS ASSOCIATION.

Convention Hall, Terre Haute, Ind.,
March 11, 1914.

The Indiana gas men had on several accounts good cause for congratulation this morning. To begin with the Sun, evidently with knowledge of "a bashfulness," which later on would be sufficient to cause the Moon to hide her pale face, was out in positive grandeur; the second was in the pleasing fact that the gas show set up proved a total eclipse of all preceding exhibitions of like nature inthe Hoosier State. In this connection let me here report that 30 separate displays were given, a notable one being that which showed a good working example of a surface combustion broiler. The show building was about as pleasing and effective an example of illumination as could have been arranged, the main feature of it being twelve 5-mantle gas arcs. To tell the truth, more than likely the much largest part of the credit for the display should be given to the President of the Association—Mr. A. S. Cooke—who for weeks has been giving personal attention to its procuring, assembling and arranging. Direct mention of President Cooke, however, unfortunately brings prominently to mind that that clever gentleman was in sad physical condition, through a severe attack of sciatica. Indeed so crippled was he on account of that arch enemy's assaults, that, having welcomed the delegates officially, he was obliged to turn over the actual direction of affairs to Vice-President A. C. Blinn. Mr. Blinn, however, despite the exigency that put this work upon him, carried the proceedings along smoothly and without delay; in fact, his action and procedure were those of a veteran in respect of chairmanship. Mayor Don Roberts welcomed the delegates in a most genial way, and in the course of his well considered, well spoken speech, voiced the belief that all public utilities should have a fair return on their investments. That big bodied, clever headed, wholesouled, member of the Board of Directors (Mr. O. O. Thwing), in responding to the welcoming message of the Mayor, was especially eloquent this morning, but, as is usual with him, the humorous vent in the penumbra was not to be denied. To be frank about this, Mayor Don remarked he hoped the members would all avail themselves of the opportunity to make more or less inspection of "Our Progressive City;" and in replying to that pleasant suggestion the Sage of Fort Wayne, intimated that many of the delegates had casually looked around the aforesaid "progressive" over night. The Honorable James L. Clark, member the Public Service Commission of Indiana, then outlined his "Interpretations of the Public Utilities Law and its Probable Effect on Such Public Utilities." His really masterful presentation of these important relations, carrying as it did a great fund of valuable information regarding matters of vital import to the artificial lighting and heating industries of the State, was received with great acclaim. And its influences were further accentuated in the response thereto, which was delivered in best vein by that prince of America's gas men—our well-loved James W. Dunbar, with whom time deals in gentlest way, and upon whom fortune continues to beam—and so may it be. The Commissioner was awarded a rising vote of thanks for his courteous attention, and then

some routine matters were threshed out. As Secretary, Mr. Philmer Eves reported a total membership of 158, thus classified: Honorary, 1; active, 97; associate, 60. As Treasurer, Mr. Eves reported a good balance in the bank, and a general safe standing of the Association in all respects. Then came a speech from Mr. Eves, which we did not like to hear. Referring to his 6 years' continued service as Secretary and Treasurer, the trials and tribulations of which dual position were softened and smoothed by the clever assistance of his superior executives, and of the members generally as well, he announced his declination of a re election to office. This action became necessary through his having determined to take a long trip abroad. However, the action was final, and if the expressions of good will that were so abundantly meted out to him, after the statement of his determination, are to illuminate him during his trip, no other journey was ever made midst finer, softer lighting glows.

The address[1] of President Cooke, which was read by the Secretary, was a plain statement respecting affairs which concerned all of them, and well merited the applause with which its closing was punctuated. The paper list to-day was notable for that by Mr. O. O. Thwing, whose studied and scholarly chapters on "Employees' Compensation," brought out a discussion that shows how close this important topic is to the thought of the gas employer. Another disappointment was registered when it became known that Mr. J. B. Klumpp, of Philadelphia, who was in for a paper on "Calorific Value, as Expressing the True Quality of Gas and Conditions Governing Its Supply," was unable to be present. The paper, however, was in evidence, and was finely communicated by Mr. A. C. Klein, of Philadelphia. The communication is an exceedingly able one, and it may be taken for granted that its findings will be of exceeding value in subsequent discussion of this subject, be the considering place either in the executive or engineering divisions of a company or in the halls where legislators discuss changes in the governing laws respecting these matters. At the close of the discussion, which was exhaustive and animated, the Association wired (to Miami, Fla., where Mr. Klumpp is temporarily sojourning) its ardent hopes for his speedy restoration to health, and its congraulations over the excellence of his paper, which had been greatly enjoyed and thoroughly appreciated. Some general routine business was transacted, after which (about 4 P.M.) an adjournment was ordered so that a close inspection of the gas show could be made *en masse*. The public were invited to the show in the evening, and the technical proceedings consisted in the lecture (it was rather more that than a paper) by Mr. R. F. Pierce, of the Welsbach Company's Illuminating Engineering Laboratories, on "Light and Illumination." It is needless to say that the subject was in the thought and speech of a master along the lines indicated, and his narrative was clearly and cleverly abetted by an intelligent handling of appropriate slides. A "Dutch Lunch" was spread at 9 P.M., and, if opportunity affords, I will forward details to-morrow.—E.

THURSDAY EVENING, March 12, 1914.

The combined sharing in the Dutch luncheon and world-wide "Smoker," last night (well served in the Terre Haute House) left nothing to be desired. Sparkling wit abetted by other "sparklers" kept things on the go; and in reality assisted in making light of some of the stories told. This morning was, as to weather conditions, perfect, but the continued indisposition of President Cooke was cause for regret. Chairman Blinn, however, continued his clever executive directing. The paper on "Yields of Gas from Coals," by Mr. J. C. Silverthorne, of Evansville, Ind., had so many valuable suggestions that general opinion thereon was that it should stand as the basis for further investigations along like lines. The officers elected were:

President.—A. C. Blinn, Evansville.
Vice-President.—J. H. Maxon, Muncie.
Secy.-Treas.—J. W. Dunbar, New Albany.
Directors.—O. O. Thwing, J. N. Moncriefe, R. A. Lawlor, A. C. Vance and J. C. Silverthorne.

The result of the election was a splendid surprise, especially in respect of the knowledge that our own Dunbar had consented to take up the work of Secretary-Treasurer. The announcement was received with cheers. Mr. Eves was elected to honorary membership, and was then presented with a sparkling diamond stud, the presentation being made by Mr. Maxon, both of which graceful acknowledgements of his services evoked from the recipient a speech expressing his appreciation of the friendship thus shown, thanking the members for their loyal support and congratulating them on having prevailed upon Mr. Dunbar to again take up the executive routine. Several gave expressions to their regret over Mr. Eves' resignation, but Mr. Eves suggested they rather should congratulate him, in that his present programme meant a trip to the Bermudas, as a prelude to a visit to the North of Scotland, where he proposed to remain during the summer. The next place of meeting is Indianapolis. Mr. O. O. Thwing, as the delegate of the Association in respect of the International Committee on Gas Congress (San Francisco, 1915) presented a report, completely outlining the work so far done in this regard. Having considered the findings, the Association decided to hold an "Adjourned Meeting" at the time of the Pan.-Pacif. Exposition, thus assuring the Association's co-operation in the movement to cause the 1915 gathering an epoch in the history of the gas maker's art. The meeting adjourned at noon, to again visit the gas appliance show, which certainly was a pronounced success from any and all view points. Over 1,000 visitors inspected the show yesterday.—E.

1, See JOURNAL, page 167.

BRIEFLY TOLD.

ENGLISH COMPANIES BUYING GERMAN GAS COALS.—The English newspapers for several weeks past have been largely given to comments and discussions on the reported purchase, by London gas companies, of a million tons of German coal. While the rumors cannot be officially confirmed, there has yet been no formal denial, and in some quarters it is considered that the reports are largely for influencing the British coal interest, whose late increases in prices asked make, it is said, possible to import coal at a net saving of as much as 37 cents per ton. It is not at all likely that such excitement is without foundation in fact, but it is quite possible that the quantities quoted are much larger than the facts warrant.

CURRENT MENTION.—

MR. JOHN MITCHELL, City Manager, Hickory, N. C., invites sealed bids, to be received in the city building, until noon of the 24th inst., for the purchase of a franchise for the construction, operation and maintenance of a gas plant. The life of the franchise is put at 35 years, and the purchase price shall be based upon a percentage of the annual gross receipts therefrom. Mr. Mitchell holds himself in readiness to furnish any information desired.

THE voters of St. Petersburg, Fla., have (140 for, 60 against), decided in favor of a bond issue ($148,000) to raise funds for the construction of a gas plant to be operated on municipal account.

THE Board of Aldermen, Wilson, North Carolina, has ordered an election, to be held the 9th prox., for the purpose of determining as to the advisability of granting to the Southern Gas Improvement Company a franchise for the construction and operation of a gas plant. It is agreed that the ultimate cost of such plant shall not be less than $100,000.

MR. DEAN W. FLOWERS has been appointed Superintendent of the St. Paul (Minn.) Gas Light Company. Mr. Flowers is a graduate of the Ohio State University, and later on (1906) was appointed Chemist and Engineer of Construction to the Binghamton (N. Y.) Gas Company, subsequently becoming its Superintendent. Later he became Superintendent of the Long Branch (N. J.) Company, both as to its gas and electric division. He is a go-ahead chap, but not so speedy as to permit the pace to get the better of him.

THE shareholders in the American Gas Company are, no doubt, thoroughly united in saying to their executives, "Better than well done has been your work." At least such we infer would be their thought on glancing over the figures submitted to their scrutiny by President M. W. Stroud as to the net earned in the last year. It figures at 11.25 per cent. on the average volume of stock outstanding during the twelvemonth.

MR. RICHARD L. AUSTIN, President of the Brooklyn Borough Gas Company, which does business in the Gravesend and Coney Island districts of Brooklyn, N. Y., has been elected President of the Girard National Bank, Philadelphia—Mr. Austin has been a valuable member of the Quaker City's best banking interests for well over 50 years.

AT the postponed meeting of the shareholders in the Union Gas and Electric Company, Cincinnati, O., these Directors were elected: T. F. Wickham, W. Y. Cortwright, W. S. Cox, Polk Lafoon, G. W. Crawford, F. B. Enslow, J. C. Ernst, August Herrman, P. G. Gossler, W. W. Freeman, A. B. Leach, M. E. Moch, C. R. McKay, L. J. Hauck and J. M. Hutton.

(Continued from page 167.)

enlarged field of usefulness and public service which confers untold benefits, advantages and economies not enjoyed by earlier generations. Much is due to appliance manufacturers, through whose efforts the channels for the use of gas have been multiplied many times, to the comfort of our homes and the convenience and economy of our commercial and industrial interests.

Were the public educationally advanced in the knowledge of gas, and the way to use it, in proportion to the advanced knowledge of those in the business, we should at this time be standing on the common ground of public co-operation; but, as the consumer has lagged behind in the advance movement, it follows that our efforts should be conducted along the lines of publicity, which should not alone be confined to combating the question of price, but to the upbuilding of recognition of the value of the service we render.

Hearty co-operation with the public service commission will do much to hasten forward that condition which we all desire and are striving for, and the commission, through the functions of its honorable and helpful office, will accomplish much in the way of changing public sentiment, where we ourselves are powerless, because of our efforts and intentions being viewed through a veil of distrust and suspicion, the mesh of which is so fine that the true mental vision is warped and restricted.

We recognize that the public utility law is a measure that interposes a medium of co-operation, and a measure of adjustment applying with equal force to the modification of unjust criticism and the upholding of our rights, a measure that will dispel the erroneous impressions regarding the variability of service charges where varied conditions and results of operation, without attendant publicity, have so often been misunderstood.

The application of the public utility law has been intrusted to a commission, a body of men of high standing in our State, men whom we believe are, and have shown themselves to be, earnest in their intention to apply the law with impartality and justice to all parties concerned. This commission has full authority to investigate utility conditions within our State and to render decisions in accord with its findings. In this way we are relieved of the burden of self-justification, and eventually our true position will be established. In any case victory or defeat should not be looked upon as the triumph of the strong or the failure of the weak, but rather in the light of an equitable dispensation of rights according to merits. Therefore, let us see to it that our merits' score is complete.

This Association has resolved to freely co-operate with our Commissioners. It will do so in all honesty and with a desire to attain results that will be satisfactory to gas company and the gas consumer. Let us assist in carrying out the utility law, to the confusion of our critics and the benefit of our trade.

In order to facilitate the work of the commissioners, and as far as possible establish uniformity of procedure, it is herewith recommended that a permanent committee be appointed by this Association to confer with the commissions on all subjects of a general nature pertaining to our industry. Unquestionably much can be accomplished and more satisfactory results attained by this co-operative method.

It must not, however, be inferred that co-operative action is to be extended to the commissioners only, for it must equally apply to those with whom we have dealings of any kind, and the same spirit should permeate our own ranks in active form. We should all work for the general good, for by so doing, the largest benefits will accrue to all concerned. Elbert Hubbard spoke truthfully when he said, "We make our money from our friends," and they are our friends by reason of co-operation and the get-together attitude.

Let every member of this Association resolve that henceforth he will put forth his best efforts towards making this Association a leader in the ranks of gas associations; that he will hereafter be a live member, or make way for one more worthy; that he will shoulder his share of Association burdens and thus relieve those who carry a double load.

Our big, clean industry demands that we promote its interests, and this cannot be done in full measure if we as individuals fail to contribute our mite to the cause. The smallest part of this mite is our annual dues. Work is the greatest. When we all realize that a receipt for dues is a license and a call to work, our grand old organization will be enabled to fulfill the purpose of its corporate existence.

When, with a full sense of co-operation, we appreciate that the public we serve are the ones for whom we labor; that to them must we look for our reward; and when we realize that their satisfaction is our success, we must conclude that, by united action only, and not alone through individual effort, can we attain that position which commands confidence and respect. Then will our institution be referred to as an asset of which the community is proud, rather than be treated with contumely and suffered as a necessary evil.

In order to help yourselves your policy must continue to be to help others. Interpreting this properly its meaning is: "Promote the interests of those you serve with all your ability; in all honesty of purpose, and your promotion must follow." In all your thought and actions let the spirit of co-operation prevail.

I wish at this time to express my thanks to the Directors and our most effcient Secretary for valuable support and assistance accorded me during the past year, and in closing, to express a hope that every member of this organization will intensify and increase his interest in this Association.

Studies in Electrolysis Mitig tion.

The National Bureau of Standards recently made an examination of the conditions in Springfield, Ohio, as to stray electric currents and their effects upon underground pipe systems. In reporting thereon the Bureau devotes considerable space to a discussion and description of methods generally used or advocated for protection to pipes, which is of interest to distribution engineers and managers.

Under methods applicable to the pipes three schemes are noted:

Painting or Otherwise Insulating Pipes.—Some 40 kinds of paints were tested, but not one stood up under the very moderate test potential of 4 volts for any considerable length of time, failure of the coating with pitting of the pipe occurring within a few months in all cases. None of the paints were absolutely impervious to moisture, they become slightly conducting and a trace of current flows, at first giving rise to slight electrolysis and gas under the coating. As this gas increases, the coating is ruptured, the current is increased and rapid electrolysis of the exposed iron follows. If the coating be sufficiently porous, it may remain intact and electrolysis continue beneath.

Coating pipes with treated textiles or tarred paper is open to the same objections though the time required for initial failure is greater. We have tested a considerable number of such coatings with uniformly disappointing results.

Insulating Joints in Pipes.—If properly installed, and used with sufficient frequency, they can be made very effective. Insulating $\frac{1}{3}$ or $\frac{1}{4}$ of the joints is usually sufficient, even under severe voltage conditions, while often a much smaller percentage would suffice. In old piping systems this expense becomes great, unless the potential gradients in the earth are first reduced by other means so that a small number of insulating joints will be sufficient.

Pipe Drainage Schemes.—A system of wider application than any other is "pipe drainage." This method has taken a variety of forms:

(1) *Direct Taps between Pipes and Rails.*—At various points throughout the positive areas they are connected by short, heavy cables. The potential gradients along the pipes throughout the region are then the same as in the rails. Commonly this produces heavy currents in the pipes and, if high resistance joints are encountered, the large leakage of current around the joint will cause rapid injury to the pipes.

(2) *Negative Feeders to Pipes.*—This consists in running negative feeders direct to various points of the pipe system. In some cases it has been proposed to run long feeders parallel to the pipes and tap to them at frequent intervals. In some installations boosters have been connected to the longer feeders, so that they can be made much smaller, and any desired amount of current can be taken from the pipes by each feeder.

Any form of pipe drainage will necessarily increase the current carried by the pipes, which is accompanied by the ever-present danger of trouble developing on high resistance joints. Connecting the pipe system to the busbars or rails, lowers the potential of the pipes and tends to make them negative to other pipe and lead cable systems, thereby endangering the latter. This method also increases the life and fire hazard, particularly in connection with gas mains. All pipe systems to which it is applied should be electrically continuous throughout, but in a great many installations, cement, rubber-gasket and other insulating joints are now largely used. The greatest objection to pipe-drainage systems, and to all the other methods mentioned, is that they are designed to relieve the symptoms rather than to remove the cause. As a rule, the effect is at first apparently bene-

ficial, reducing the danger in positive areas more than it increases it elsewhere, but as the railway grows, the current in the pipes may become so great that the consequent damage will be greater than the reduction of troubles in the positive areas.

Among other methods proposed may be mentioned (a) surrounding the pipes with certain inhibitive chemicals, such as lime, etc., (b) cement coatings on the pipes, (c) maintaining pipes negative to certain structures by means of battery, motor generator, etc., (d) favorable location of pipes with respect to rails, (e) use of noncorrodible conducting coatings, and (f) electric screens—sheets of metal placed near to or surrounding a portion of the pipe and electrically connected thereto. Our investigations have convinced us that none of these can be considered seriously.

Methods Applicable to the Railway System.—There is no question but that the double-trolley system would entirely eliminate electrolysis by railway currents, but the cost of installation does not appear to be justified. Engineers recognize the futility of trying to maintain a proper state of track conductivity by merely bridging the joints with copper bonds, the tendency being to make the joint electrically continuous rather than to shunt around it. Cross bonding the rails is also much resorted to. All special work should be shunted by copper cables capable of carrying all of the current passing over the tracks at that point, the drop across special work often giving rise to very serious electrolysis. A properly drained roadbed is also a very effective aid in reducing the leakage of stray currents from the rails.

Uninsulated Negative-Feeder Scheme.—This has been much used to increase the conductance of the track. With feeders costing $4,000 per mile for cables of 1,000,000 circ. mil. section installed, the most economical potential gradient to allow in the rails is about 3 volts effective per 1,000 feet with power costing 1c. per kw.-hr. Wherever the potential gradient exceeds that figure, the addition of copper in parallel with the rails produces an annual saving more than sufficient to pay interest, taxes and depreciation on the copper required to reduce the potential gradient to 3 volts. When this value is exceeded in any locality, that section of track is being operated at an unnecessary loss, and electrolysis conditions are unnecessarily bad. In carrying the voltage limit below this value, the cost of the necessary copper soon becomes prohibitive, still a potential gradient of 3 volts per 1,000 feet is too high to give immunity from electrolysis.

Insulated Negative-Feeders.—In this scheme the connection at the power house is either removed or given a suitably high resistance, and insulated feeders are run from the negative bus to various points of the track. Current being taken off the rails at numerous points, high current densities and high potential gradients in the rail are avoided. Insulated feeder systems embrace a number of modifications, chief among which are the following:

(1) *Boosters in Separate Feeders.*—A method used in Europe is that of inserting a booster in each feeder or group of feeders. By varying the voltage of the individual boosters, almost any desired potential conditions can be had in the track network. The copper feeders can be designed for economy and a much more economical installation can be obtained than where the drop on the cable must be no greater than the drop on the rails.

(2) *Without Boosters.*—The potential necessary to force the required current through the negative feeders without the use of additional copper is obtained by removing the direct tie between negative bus and rails at the power house, and substituting a resistance tap.

(3) *Single Booster Scheme.*—This method is designed to eliminate the disadvantages of the insulated negative feeder scheme with and without boosters. All of the negative feeders except the power house tap are brought to a feeder bus and a single large booster is connected between this and the negative bus of the generators. Proper distribution of current between feeders is secured by proportioning their resistances.

(4) *Inverted Booster Scheme.*—This differs from the method without boosters only in the substitution for the resistance tap of an "inverted booster;" that is, a booster so arranged as to produce a counter e.m.f. in the power house tap sufficient to cause the proper amount of current to flow over the insulated feeders. It consists of a series motor in the tap circuit coupled to a practically constant speed generator feeding some external circuit.

The effect of the number of feeding points on the potential drops in the rails, and the consequent leakage of current from the tracks, is obvious, but the economic aspect is complex. As the number of stations is reduced the capacity of each must be increased, with the result that the current flow and potential gradients in the rails approaching the power house will be greater. It can be shown that the current picked up by the pipes may be increased as the second, third, or even higher power of the distance between drainage points, according to the character of the system. Any increase in the number of such points will reduce in much greater degree the flow of stray currents in the pipes. The number of drainage points can be increased to any extent desired, by the proper use of insulated negative feeders, but the fewer the stations the longer and heavier the feeders must be. An increase in the number of stations may often prove pronounced economy when we consider the distribution of the power on the positive side as well as its return on the negative.

In designing a method of electrolysis mitigation, therefore, many things may have to be taken into account quite apart from the technical points regarding the electrical condition of the negative return, if a proper balance is to be maintained between the cost of making the proposed changes and the benefits resulting therefrom.

The Extent of Mineral Waste.

[From the Forthcoming Third Annual Report of the National Bureau of Mines, JOSEPH A. HOLMES, Director.]

It is a reasonable estimate that the present waste of mineral resources, in large measure unnecessary, amounts to a national loss of not less than $1,000,000 a day.

Our crops are an annual production from a reasonably permanent soil; our forests may grow again, though a much longer period of time is required; and the soils themselves may be reproduced from the subsoil and the rock beneath; but of our mineral resources we have only the one supply. This supply is destroyed in use; and at the present increasing rate at which we are using and wasting, it will be exhausted or largely depleted while the Nation is yet in its youth.

The most urgent need for reform is in connection with the unnecessary waste of oil and natural gas that still prevails in many parts of the country. With the limited facilities at its disposal the bureau has been able during the current year to stop a waste of natural gas valued at not less than $10,000,000, an amount that exceeds by six times the total cost of the bureau's investigations. There is need of enlarged facilities to push this work more rapidly, as with few years further delay this valuable source of national wealth will have been permanently lost.

The operators in causing this waste have followed their natural bent for temporary gain, and the States have permitted it without protest, fearing that interference might retard development. Will the National Government do the same? The saving already accomplished was the result of inquiries and researches that enabled the engineers of the bureau to demonstrate to the men in the Oklahoma fields that much waste of gas could be prevented without stopping the drilling for oil.

If the funds at the disposal of the bureau had been large enough to provide for more extended investigations and demonstrations, the saving would have been greater, as in new parts of the Oklahoma fields the waste of gas that still continues is equivalent to $15,000,000 to $20,000,000 per annum; and this waste in all of the oil and gas fields of the country aggregates more than $50,000,000 per annum; Of the total waste of gas in the oil fields of the country more than 80 per cent. is believed to be easily preventable, and from the remaining 20 per cent., it is believed that gasoline may be extracted and the gas itself burned for some useful purpose.

The need for enlarged investigation is further shown by the fact in addition to this waste of gas the waste of petroleum, in pumping and storage, is much greater than is ordinarily supposed. However, the injury done in some fields through the flooding of oil and gas strata by underground water, is another phase of the subject, calling urgently for investigation.

It is estimated that the proposed investigations into the waste of oil and gas would cost from $30,000 to $40,000 per annum, and it is believed that the saving to the national wealth would be more than a hundredfold for each dollar expended.

Waste in coal mining is another serious drain on our national wealth. A preliminary estimate indicates an annual waste or loss of coal in mining and handling of not less than 250,000,000 tons per annum, from our best and most easily mined coals and those nearest our great centers of industry. What is needed is a thorough under-

ground survey and examination at selected areas in each of the important coal fields of the country, with a view to determining the exact conditions under which mining operations take place and the possibilities of adopting less wasteful methods. Such an investigation would cost about $50,000 per annum for 3 or 4 years, and it is confidently believed that the results would mean a saving in fuel resources of more that $50,000,000 per annum.

There is need of similar investigations of the wastes or losses in the mining, preparation and treatment of metalliferous ores, which, in some cases, amount to from 10 to 50 per cent. of the total yearly production of such minerals. A few of these wastes may be regarded as representing a deferred use of the materials, but many others are a total and permanent loss, and in the majority of our metals this reduction in our national supply will at no distant date become a serious problem. Investigations relating to safety and waste in connection with our metal mining and metallurgical operations are already under way, but they are quite inadequate to meet the need.

Rust-Proofing Iron and Steel Articles.

Mr. E. L. Blassett, in a recent issue of "Metal Industry," declares that one of the greatest metallurgical problems of the day has been to produce a non-corrosive surface on iron and steel by chemical or electrochemical methods. The ideal process should not destroy the physical properties of the metal, such as its temper and resilience, and the finish should be dark or black in color. All electro-deposits are apt to wear through in a short time, and when this happens, oxidation rapidly takes place and the rust forming underneath the deposit forces it off. This is not so with a finish produced by the Bower-Barff process, or by Coslettizing, in which the surface of the metal treated is converted to the black oxide of iron or phosphate of iron.

The production of the black oxide of iron (Fe_3O_4) on surfaces has been practiced for many years and is the oldest of the purely chemical methods. The fact that iron became coated with the black oxide, when treated with superheated steam, was noticed at an early date, Prof. Barff being the first to seek to apply the principle industrially, but it remained for later investigators to perfect the method so that it may be used as a commercial finish. There are three such processes in use at the present time, known as the Bradley rust-proofing process, the Bontempi process and the cold process; the latter being used especially on edge tools. When the surface of iron and steel has been converted to the black oxide, corrosion ceases, as no more oxygen can be taken up by the iron. All processes using high heat for producing the black oxide must necessarily have a limited application.

In 1876 F. S. Barff was granted a patent in England for an "Improvement in Processes for Protecting Iron Surfaces." In his process the articles to be treated were heated to a red heat in a closed vessel, followed by the injection of superheated steam. In 1880 G. and A. S. Bower were granted patents on a method for "Coating Iron with Oxide," consisting of heating the article in an atmosphere of carbon dioxide, instead of steam. This process was based on the fact that, when iron is heated to a red heat with carbon dioxide, it will reduce the carbon dioxide to carbon monoxide, and the iron itself is converted to the black oxide. Much difficulty was encountered in using these methods, and the oxide was apt to scale off and be without uniformity. Improvement made by G. W. Gesner in 1888 was the next step in the development of this process, his modification consisting in introducing an hydrocarbon (such as naphtha) with the steam. The black oxide produced by the Gesner method contained hydrogen, which rendered it less liable to scale. All these early methods had the great disadvantage that uniformity was not always possible, and the red oxide (iron rust) was frequently formed simultaneously with the black oxide. The latest improvement was made in 1908 by J. J. Bradley, and is known as the Bradley rust-proofing process. By this method a more durable and uniform finish is produced, and the red oxide is not formed. The articles are heated to a red heat in a muffle and hydrogen gas is then introduced, with gasoline in small quantities, to improve the color of the coating. To produce an even finish the article to be treated is first cleaned by tumbling, pickling or preferably sand blasting. The articles are left in the furnace for about an hour, then taken out and allowed to cool, and finally oiled with linseed or paraffine oil. The oiling improves the color for decorative purposes. Steel, malleable iron or cast iron may be treated by this method, and the coating produced is impervious to the action of the atmosphere.

The Bontempi rust proofing process, patented a few years ago, is also a modification of the original Bower-Barff process. The Bontempi method consists in heating the article as in the Bradley process to 900° F. or more, then passing in steam and the fumes of zinc, or some heavy hydrocarbon, such as tar. A very heavy oxide is produced depending upon the length of time the article is treated, invariably uniform and of a deep black color. It is claimed to withstand corrosion for an indefinite time. The inventor has recently improved the process and obtained a patent for the use of various substances, claimed to accelerate the formation of the black oxide.

The cold process for producing the black oxide can be used on a large variety of goods, especially edge tools and general hardware. Although used extensively at the present time, it is likely to be discarded for simpler and more economical methods, and "Coslettizing" or some such process may supplant it. There seems to be no record of the origin of this process, but it has been used for many years, especially for finishing gun barrels. The black oxide produced is much lighter than that from heating and is not considered so highly resistant to corrosive action, but is considered sufficient rust proof for a large variety of goods. The article should be cleaned as for plating, after which it is coated over with a solution composed of:

Water	4 ounces.
Alcohol	4 ounces.
Ferric chloride	½ ounce.

The solution is applied with a sponge, well squeezed out before applying it to the work, as too much solution on the sponge will not produce the desired results. The articles are then placed in a warm, moist atmosphere, a chamber heated by steam, the exhaust from the steam coil giving the necessary moisture. The articles are steamed 45 minutes, and then immersed in clean, boiling water for 15 minutes. After removing from the water bath and cooled, the work is scratch-brushed on a fine wire wheel brush. To obtain a durable black oxide, it is necessary to sponge the work with the solution two or three times, followed by steaming, hot water treatment and scratch-brushing as in the first operation. After the final brushing the articles are oiled with linseed oil and carefully wiped.

There are several modifications of this process in which other solutions are employed, but the results are not any better.

There are various other methods for producing the black oxide. It may be produced by immersing in molten nitre (nitrate of potassium or saltpeter) or nitrate of sodium (chile saltpeter). This is known as steel bluing, but the color may be blue or black, depending upon the length of time the article is immersed and the heat employed. Small articles, such as steel buttons and buckles, may be given a black finish by tumbling in a sheet iron barrel heated to the right temperature by a gas furnace. Heating in charcoal also produces a blue or black oxide, and the process is extensively used on revolvers and general hardware. These methods, however, do not give a finish that is rust proof, as the oxide formed is too thin.

The method known as Coslettizing, very simple and economical, may be regarded as the most advanced step in rust proofing. It consists of producing upon the article a coating of phosphate of iron (Fe_3PO_4), which is quite impervious to the action of the atmosphere. This process was discovered by Thos. W. Coslett, Birmingham, England, and patented in England and in the United States. It is now extensively used on typewriter parts, harness trimmings, and general hardware, and articles of the most delicate nature may be treated without injury.

The solution for Coslettizing is made as follows:

Concentrated phosphoric acid	½ gallon.
Water	½ gallon.
Iron filling	2 pounds.

When the iron is thoroughly dissolved, this solution is added to 50 gallons of water. A wrought iron tank is necessary to hold the solution, which should be heated close to the boiling point by a gas stove or a steam coil.

The work to be treated is first cleaned as for plating, if necessary pickled in the usual muriatic dip to remove rust. The work is suspended in the solution by iron wire hooks; small articles, such as screws or bolts placed in baskets, and allowed to remain in it from ½ hour to 3 hours, depending upon the nature of the work or the thickness of the coating required. This process produces the most rust resisting finish for iron and steel by simple immersion in solution

that has been discovered. A very slight amount of the surface of the article treated is converted to the phosphate of iron, but most of the coating comes from the solution. When the solution is working properly, a heavy coating is produced in 2 or 3 hours. When removed from the solution it is allowed to dry in the air. If it is to be used for ornamental purposes it should be scratch-brushed and oiled.

Electrogalvanizing is unquestionably the most durable and practical rust proof finish that can be produced by electrodeposition. The work to be rust proof should be given a heavy deposit so that it may not be readily worn off by friction. The solution usually employed is composed as follows:

Zinc sulphate	2 pounds.
Aluminum sulphate	2 ounces.
Water	1 gallon.

A good, heavy, deposit of brass, copper or nickel on steel and iron retards corrosion for a considerable time, and these methods are too well known to describe here. Black nickeling seems to be the only method for producing a black finish directly on iron and steel by deposition that is fairly rust proof. To produce it the following formula is generally used:

Double sulphate of nickel and ammonium	10 ounces.
Zinc sulphate	1 ounce.
Sulphur cyanide or potash	2 ounces.

Black nickel deposits should be lacquered or oiled to further retard corrosion or prevent staining. Another solution that produces a black finish by the use of the electric current is as follows:

Lead nitrate	12 ounces.
Ammonium sulphate	8 ounces.
Water	1 gallon.

The articles to be colored are hung on the positive or anode rod. For a cathode, sheet steel may be used. This solution merely colors the work and the finish should be oiled or lacquered when it will keep from rusting for some time.

New Methods and Appliances.

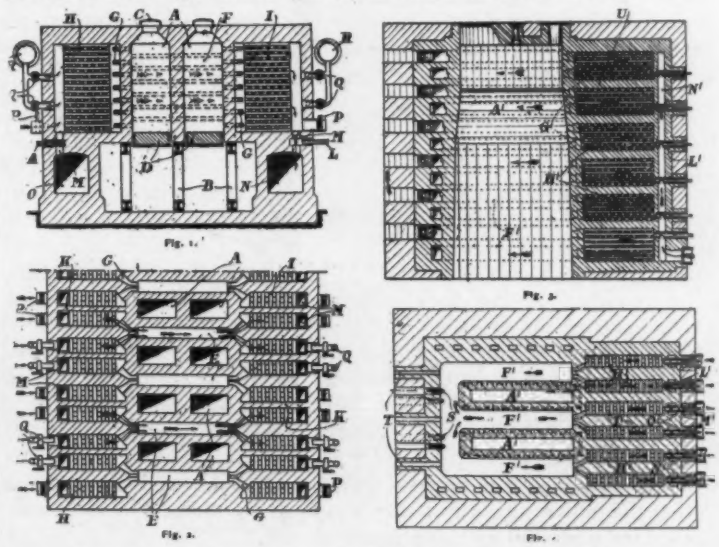
IMPROVED KOPPERS' DESIGNS.—There has recently been published the specification of a French patent taken out by Herr Heinrich Koppers for improvements in vertical gas retorts and coke ovens.

The object of the invention is: (1) To establish a simple circulation of the hot gases as free as possible from leakage in the settings of vertical retorts. (2) Locate the retorts, as far as possible, in the part of the setting where the heat is greatest. (3) Keep the space under the retorts free, so that the linings can be removed from the chambers. This object is accomplished by conveying the hot gases horizontally, in the heating walls surrounding the retorts or chambers, from their exit from the heat regenerator to their entrance to the chambers, and especially by means of heating flues which are constructed around the chambers, and terminate at their mouth and extremity in regenerators running laterally along the full height of the retort. The single current of heat thus becomes a bond of union in the parts situated at the same level in a waste heat and air regenerator; and this bond does not alter its direction vertically. The result is a complete utilization of heat, because the hot gases also pass horizontally through the regenerators.

In order to form zones in heating, and especially to obtain continuous distillation, the heat regenerators, conformably with a development of the present invention, are first divided by horizontal partitions into superposed compartments, each separately regulatable. This is effected by dampers controlling the entrance of air into a preliminary chamber common to all the superposed compartments, or the escape of the utilized air. With this device, it is possible to check from the outside the too high heating of any layers. This system of regulation is completed by the employment of chambers with a greater slope at the top than in the lower part, because during emptying there is no cause for interruption of the filling, which is often brought about by the considerable heating of some horizontal layers.

The whole of the installation is clear and simple in construction, especially as regards the heat flues. The space below the setting is quite free, and the chambers, particularly in the case of the heat regenerators on either side, are in the center of the stream of heat. Owing to the natural rise of the zones of heat one above the other towards the exterior, the loss of heat by radiation is small.

Two forms are represented in the cuts. Figs. 1 and 2 show in vertical section and plan an installation with heat regenerators on the right and left of the retort chamber; Figs. 3 and 4, one with hot air and waste heat regenerators placed in alternation on one side.



The chambers or retorts, *A*, arranged in pairs side by side and supported on piers, *B*, are closed at the top by lids, *C*, and at the bottom by sole-pieces, *D*; but the design of the retorts may be such as to allow of continuous work. Each pair of retorts is surrounded by two heating chambers, *E* (Fig. 2), divided into horizontal passages (Fig. 1), connecting by nozzle-shaped branches, *G*, with the heat regenerators, *H*, *I*. These are divided into two parts by partitions, *K* (Fig. 2), and the parts are in turn connected with the heating chambers at the front and back of the retorts. The regenerators have branches, *M*, on the heat flues, *N*, *O*, which can be closed with dampers, *L*, and they have air dampers, *P*, and branches, *Q*, on the gas pipe, *R*, alternating with each other.

The peculiar feature of the working is that when, for example, communication between all the heat regenerators, *H*, and the waste heat passage, *O*, is cut off by shutting the damper. They are then, according to their order of juxtaposition, fed with gas through the pipe, *R*, and air through the orifice of the branch, *P*. After passing through the branches, *G*, combustion is produced in the chambers, *E*, while the waste heat enters through the orifices, *G*, into the regenerators, *I*. Here the branches, *Q*, for the gas, and the air dampers, *P*, are shut, while the dampers, *L*, are pulled out, and make connections with the waste heat passage, *N*. After the excess heat has been absorbed by the lining of the heat regenerator, *I*, the used gas is conveyed to the chimney through the flue, *N*. The positions of the dampers are then reversed, and the direction of movement, with each change of current, at intervals of about 30 minutes. An intake corresponding to a horizontal flow is assured in the heat regenerators by the resistance of the dividing walls combined with the pressure; and, by suitably selecting the intake points for gas and air, distribution of the combustible gas to be heated, over the entire height of the heat regenerator, can be perfectly regulated.

The two retorts, A^1, in Figs. 3 and 4, are surrounded by the heat flues, F^1, each of which is branched in front with the heat regenerators, H^1, I^1, by nozzle-shaped connections. The system of working is such that for one phase the heat regenerators, H^1, receive gas and air at the extremities, while the two intermediate regenerators, I^1, take away the waste heat. With a change of direction, which occurs every 30 minutes, the current is reversed, and the two intermediate regenerators receive gas and air, while the four outer ones, H^1, store up heat. Distribution of the fuel gas can be sufficiently regulated by the dampers, *S*, worked from outside according to requirements noted through the sight-holes, *T*.

The regenerators are vertically divided into compartments by walls, *U*, and each compartment communicates directly with two heat flues, H^1 or I^1. The intake of the various regenerators can be regulated by means of dampers such as the rotary dampers, L^1, M^1. Thus heating can be regulated in such a way that the middle zone, for example, where the coke is formed, will be more highly heated. Regulation of the combustible gas before it enters the heat regenerators is of special importance; just as waste gas passing out must not be discharged until it has given off the main part of its heat. At this point, however, the temperature is relatively low in both cases,

so that regulation can be effected simply and surely; while the fundamental diffusion thus established in the heat regenerators is preserved. In this form of structure, the lateral boundary-line of the chamber is more inclined at the top than at the base, to correspond with the greater expansion of the lining at the top due to greater heating there. Consequently the lining need not be rigid.

A New Continuous Chart Reording Inrtrument.—The Brown Instrument Company and the Keystone Electrical Instrument Company of Philadelphia, Pa., are placing on the market a new type of continuous recording electrical pyrometer. Great efforts have been made to produce an instrument as simple in construction as possible and of the most compact form. The case of the instrument is 15 inches high x 8 inches wide, and projects from the wall 7 inches; the space occupied having been largely reduced by placing the clock mechanism behind the record chart.

A 2 months' roll of record paper is used which can be supplied with an ink ribbon to make dotted ink record, or the record can be made on coated paper which does not require ink or ribbon. It is only necessary to wind the clock once a week and change the roll of record paper once every 2 months. Fig. 1 is the complete instrument with 10 hours record showing. One scale is placed above the record so that the indications are clearly visible at all times, and the paper has the scale printed on it for direct reading.

Fig. 2 shows the instrument with the door open, and the interior

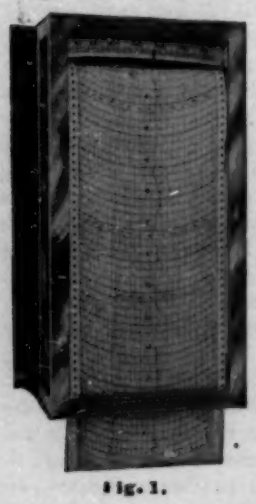


Fig. 1.

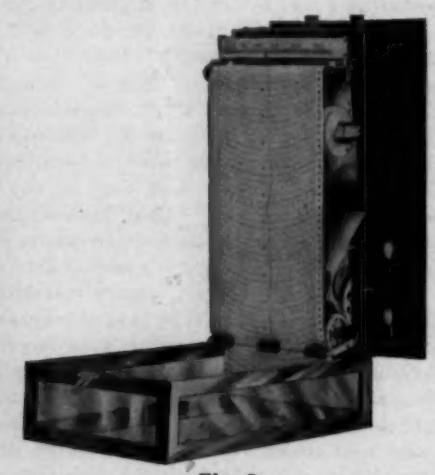


Fig. 2.

can be clearly seen; the case need only be opened to renew the roll of paper.

This continuous recording instrument will prove particularly advantageous for use in conjunction with thermo couples, for resistance thermometers for measuring low temperatures, or for recording volts or amperes. The d'Arsonval type of direct current instrument is used (frictionless type) to prevent lag in the readings, giving a particularly sensitive and accurate instrument.

Motor Spirit.—Professor Vernon Boys, the well-known authority on gas work chemistry and engineering, has devised a process for the commercial production of motor spirit from heavy mineral oil waste. The heavy waste, heated to a fixed temperature, is subjected to the intimate action of steam, at 315° C., and is then circulated through heated tubes containing a series of nickel rods. Hydrogen is liberated from the steam and combines with the oil forming a substance closely resembling natural light petroleum spirit. The process is said to yield over 40 per cent. of spirit from the crude waste, and the gaseous hydrocarbons which are produced can be used for heating the tubes containing the nickel rods. A tarry residue remains and is available for further treatment or other uses.

Gate Valve Repacked Under Pressure.—An Eastern manufacturing Company is offering for sale a brass gate valve with non-rising stem and solid wedge, which will permit of repacking while under pressure without the customary discomfort to the engineer. This is accomplished by opening the valve as far as possible and drawing the stem collar down on a fibre gasket which makes a steam-tight joint and allows the old packing to be removed without the escape of steam.

Items of Interest
FROM VARIOUS LOCALITIES.

Mr. Hans von Vittinghoff, of the Stone and Webster management, addressed the meeting of the New England Section, N. C. G. A., held in Wesleyan Hall, Boston, the evening of the 27th ult. His subject was "Hydro Electric Improvements in Connecticut," and a fine display of lantern slides, showing the new Connecticut Valley Canal during process of construction, added much to the text. Secretary Connell informs us that the next meeting of the Section will be held in Wesleyan Hall, the evening of the 27th inst., on which occasion several matters of importance are to be considered.

Drying-out fires were started the third inst. in the new one million cubic feet capacity, vertical "slot" benches of the Brockton (Mass.) Gas Light Company. The condenser house, coke plant, ammonia still and coal handling machinery are well underway, and it is thought all will be ready early in May for the starting of the plant.

Mr. William W. Mahoney, for 45 years connected with the Peoples Gas Light and Coke Company, Chicago, and its predecessor corporation, died in his home, 1119 North Shore avenue, Chicago, the evening of February 28th. He was born in Chicago 68 years ago, and was a veteran of the War of the Rebellion, having served in the Twenty-third Illinois Volunteer Infantry for a 3-year term. The funeral services were held at 10 A.M. the 2d inst., in the Church of St. Ignatius, and interment was subseq uently made in Calvary Cemetery. Two daughters survive him.

The evening of the 5th inst., Dr. L. C. Jones, Chemist and Laboratory Manager of the Solvay Process Company, Syracuse, N. Y., delivered a most interesting lecture, in the Hall of the Franklin Institute, Philadelphia, Pa. His subject was the "By-Products of Coal," and the Doctor's graphic story closely held the attention of a large audience, amongst whom were many men prominent in the gas industry.

"Erie," writing from Toronto, Canada, under date of the 3d inst., incloses this mention: "At a meeting of the shareholders of the Consumers' Gas Company, held in the Company's main offices this morning, the changes in the by-laws, which have been under consideration since the meeting early in February, were confirmed. These by-laws provide for the re division of the capital stock, authorizing the Directors to allot the unsubscribed or unissued shares of the Company's stock, making provision for the remuneration of the officers and authorizing application to be made for supplementary Letters Patent, empowering such action. Fifty or more shareholders were present, whose combined holdings were well in advance of control, and the proposed changes were adopted without dissent. The President (Hon. W. A. Austin) directed the proceedings, with General Manager Arthur Hewitt assisting. The ratings of the amended by-laws are substantially these: Providing, for the re-division of the capital stock of the Company into shares of $100 each, the issue of new certificates therefor, and the sale of shares to persons continuing to hold respectively one $50 share, and the distributions of the proceeds of such sale rateably among the shareholders entitled thereto. Authorizing the Directors from time to time to allot the unsubscribed or unissued shares of the Company's capital stock to the then shareholders of the Company pro rata, at a figure to be fixed by the Directors which shall make the premium on the stock so alloted not less than 50 per cent. of the par value of such stock, and on such further terms as may be fixed by the Directors, and providing for the disposition of unaccepted allotments and fractional shares."

Recent advices, through the courtesy of Mr. L. A. Webster, of Detroit, Mich., inform us of the death of Mr. Carl Frederick Harman, father of Mr. Henry Harman, of the Milwaukee (Wis.) Gas Light Company. Mr. Harman's death occurred the evening of the 22nd ult., at his home, 514 Sixteenth street, Milwaukee, and it was the sequel to an illness that lasted many months. Deceased was a native of Germany, having been born there December 31, 1826. In 1865 he came to America, settling in Milwaukee, where the remainder of his useful, quiet life was spent. His first direct business connection was with the old-time, well-known brewery concern entitled the Philip Best Brewing Company, and at the time of his retirement from active business (several years ago) had reached the position of malt house weighmaster. He was not a man who sought publicity

of any sort, nevertheless no other person in Milwaukee was better known in German circles, and his quiet direction of many charities in and about Milwaukee is positive testimony to the innate nobility of the man. The funeral services were held on Monday, February 25th, in S. John's Lutheran Church, and interment was made in Union Cemetery. His surviving next of kin are: His widow, a son and two daughters.

THE successor to Mr. Homer J. Eaton in the position of Manager, the Flint (Mich.) Gas Company, is Mr. F. A. Beard, Manager of the Flint (Mich.) Electric Company.

MR. ROBERT W. WELLS, Democratic candidate for the Congressional District (Fifth Maryland), is at the head of a movement to cause the Washington (D. C.) Gas Light Company to extend its mains into Prince George County, Md. While there is little likelihood that President Reeside and his associates will respond practically to this spurring, it is nevertheless an evidence of the would-be Congressman's desire to harass the proprietors of the gas supply to the residents of Hyattsville.

"C. A. Y.," writing under date of the 9th inst., informs us that, effective the 5th inst., the properties of the Port Jervis (N. Y.) Light and Power Company and of the Port Jervis Traction Company were taken over by a Philadelphia syndicate, the executives of the concern being the following residents of the named city: President, E. E. Mandeville; Vice President, George H. Stephenson; Treasurer and Secretary, M. F. Maury. Mr. W. E. Guthrie will succeed Mr. D. B. Thomas as manager, but the latter will remain in the Port for a month or so, or until Mr. Guthrie becomes familiar with the properties, the gas division of which was for years owned by the famed Marvin family.

"B. S.," writing from Norfolk, Va., under date of the 5th inst, says that the main office of the Southern Gas Improvement Company has been located in Elizabeth City, No. Car., from Henderson. Mr. J. T. Stallings is in charge.

WE understand that the Indianapolis Board of Public Works has canceled the contract with the Pressure Lighting Company under which the latter have been lighting the street lamps. An agreement has been entered into with Mr. Ragland Momand, Vice-President and General Manager, the Pressure Lighting Company, whereby the city is to have the control-use of the latter's equipment, at a rental not to exceed 25 cents per lamp per month. The contract is to run not longer than 90 days, with a further provision that the city may terminate it on notice in 30, 60 or 90 days. The Company also agrees to sell to the city such additional equipment as may be needed during the temporary contract at these rates: Globes, $9 per dozen; domes, $7; mantles, 8 cents each; chimneys, 60 cents a dozen. The city owns the posts, and the Citizens Gas Company furnishes gas at the yearly charge of $7.80; and men are paid to light and extinguish the lamps at 40 cents per lamp per month. Meanwhile it is believed the city will decide whether or not to let a new contract, or make some permanent arrangement for handling the lighting altogether on municipal account. Momand asserts he could not guarantee good service on account of dissensions amongst the officers of his Company.

THE Consolidated Gas, Electric Light and Power Company, of Baltimore, Md., responding to the invitation of the authorities to bid for furnishing gas to the public lamps, for periods of 1, 2, 3 or 5 years, respectively, offered the uniform price of 67½ cents per 1,000 cubic feet. This figure is similar to that under which the present contract is being carried on.

THE proprietors of the Roanoke (Va.) Gas Company have applied to the authorities for permission to extend their main system to and through the settlements of Raleigh Court, Ghent, Virginia Heights, and Wasena. In order to do this it will be necessary to extend the chief carrying main across the bridge at 13th street, and at Wasena. The cost of the extension is put at $25,000, and the Company declares if the necessary permission is granted the extensions will be made forthwith.

THE success of the scheme for maintainting on public account a water supply and electric current service in Virginia, Minn., is prompting the municipality to establish a gas system.

"THE annual banquet of the Employees' Association, the Lebanon (Pa.) Gas and Fuel Company, which was served last Friday in the Hotel Weimar, was a pronounced success. The attendance was large, the menu excellent, the service all right, the speeches entertaining, and the enthusiasm unbounded.—R. T."

MR. WILLIAM R. PAGE, well-known to the Eastern fraternity from his connection with the Valgren Oil Company, of Boston, died at his home in Braintree, Mass., the night of the 8th inst. He was in his 42nd year.

"V. M. M.," writing from Ossining, N. Y., under date of the 7th inst., says: "I did not see anything in the JOURNAL respecting the annual meeting of the Northern Westchester (N.Y.) Gas and Electric Club, which was held in the Society's rooms, some evenings ago. The attendance was excellent (about 50 members and several guests), and the proceedings were spirited and satisfactory. The chief business, of course, was the election of officers, which resulted as follows: President, Whitney Coleman; Vice-President, John H. Drittler; Recording Secretary, Edward J. Walsh; Financial Secretary, Jno. A. Townsend; Treasurer, Charles H. Reitzel. When the business session was closed, the party enjoyed an excellent turkey supper, the completness of which brought many pleasing references to the capability of the Entertainment Committee. The versatility of this body was further well exemplified in the vaudeville programme subsequently rendered. 'Harry' Thompson, of the Alhambra, sang several songs; Seward and Locke furnished a most edifying exposition of the tangoing art, both being suitably 'tanned' as to makeup. But the best is 'yet to come,' and that is mention of the swift work of 'Jack' Drittler, who, grotesquely done up in the habiliments affected by popular soubrettes, sang and danced himself into favor. The one bad feature of 'Jack's' array had to do with the impossibility of causing his pedals to look the part."

HERE is a synopsis of the features of the franchise which the Battle Creek (Mich.) Gas Company is asking at the hands of the voters: Life, 30 years; gas rate, for initial 7½ years, 85 cents per 1,000; and a readjustment thereof at the end of each 7½ year term, to be determined by arbitration; on accounts not settled before the expiration of 10 days the rate shall be increased 1 cent for each delinquent day, for the next 10 days, on each 1,000 feet billed; no meter rental may be charged, but in lieu thereof a minimum bill of 25 cents per month is permissible; at the end of 30 years the city has the right to purchase the plant at an agreed on figure, provided the authorities and the Company are united in respect of the terms. In case of failure to agree, the price is to be determined by three disinterested arbiters.

THE latest circular instruction respecting the governing of exhibits, during the forthcoming Panama-Pacific Industrial Exhibition, has this to say as to the rates that exhibitors will pay for a gas supply: Gas meter rates (the meters to be installed by the Exhibition Managers) during each calendar month or fraction of month: $1 per 1,000 cubic feet for the consumption in each month, up to and including 50,000 cubic feet; 80 cents per 1,000 cubic feet for the excess consumption in each month over 50,000 cubic feet. The minimum bill per month to be as follows:

Size of Installations.	Minimum Bill.
¾-inch meter	$2.50
1-inch "	5.00
1½-inch "	7.50
1½-inch "	10.00
2-inch "	15.00

THE firemen occupying the Central Fire Station, Springfield, Mo., were recently furnished with sets of gas and electric irons, to be maintained in the station for the use of those who wish to dry out their water-soaked clothes on returning from a battle with the flames. The donor was Mr. Charles Guckel, General Manager, the Springfield Gas and Electric Company.

THE Oakdale (Cal.) Gas Company has been incorporated by Messrs. J. R. and M. M. Anderson (Pasadena), and G. W. Anderson, of Oakdale. It is capitalized in $75,000.

"M. L. M.," is informed that Mr. I. W. Silvester, City Engineer, Alexandria, La., is preparing plans and specifications for the construction, and operation, on municipal account, of a gas plant for Alexandria.

MR. A. W. HIGGINS has succeeded Mr. Thurston Owens in the management of the LaCrosse (Wis.) Gas and Electric Company. The resignation of Mr. Owens became effective the first inst.

MR. J. HOWARD FORD, for some years a member of the Board of Directors, the New York Mutual Gas Light Company, died in his apartments, the Plaza Hotel, New York, the evening of the 4th inst.

Utilities Commission News.

COMMISSIONERS' SALARIES.—Payment of adequate salaries to public utility commissioners as a means of attracting a higher grade of men and obtaining best possible service, is advocated in a paper presented in the Bulletin of the National Electric Light Association.

STRUCTURES CROSSING.—The Pennsylvania Commission has passed an order regulating the crossing of facilities of one public service company with those of another public service company. Before building any structures across the structures or other facilities of any other public service company, whether underground or above ground, at the same or different levels, in the absence of an agreement between them, a company shall serve 10 days' written notice upon the company whose structures it is so desired to cross. This notice shall specify the nature and character of the contemplated crossing, and the exact location thereof, a copy, with proof of service, being filed with the commission. The commission may fix a time and place for a hearing to determine whether or not the crossing shall be approved. The regulation applies to all crossings between the structures or facilities of public service companies other than crossings between railroads and street railways.

NECESSITY MUST BE SHOWN.—In a decision issued recently the Wisconsin Supreme Court has sustained the Railroad Commission by upholding the indeterminate permit law. The decision grew out of the case of the Wisconsin Traction, Light, Heat & Power Company against the city of Menasha. The city, which has been furnishing its own street lighting service for some time, has begun to do a regular commercial lighting business in competition with the plaintiff and without the necessary authority conveyed by a certificate of convenience and necessity. The decision of the court, which was contrary to that of the lower court, held that a municipality, as well as a private corporation, must secure a certificate from the Railroad Commission to the effect that public convenience requires the service it proposes to render.

CAN'T CHARGE MORE FOR ARTIFICIAL GAS.—The St. Joseph (Mo.) Gas Company, anticipating that its supply of natural gas might be interrupted during the winter, began early in the fall to give warning to its customers that if it had to go to making gas, the rate would be raised to $1 per 1,000. When the severe weather arrived it had to turn to artificial gas to keep up the supply, and sent out bills at the $1 rate. The city promptly complained to the State Commission, and its Secretary advises that under the law the gas company has not authority to change any rate without first getting the approval of the Commission.

RAPID GROWTH AT SAN DIEGO.—In connection with a decision bearing upon the financing for the growth of the San Diego Consolidated Gas and Electric Co., the California Commission says in an opinion:

"It appears that the business of applicant is growing tremendously. For the year 1912, applicant increased its consumers of electric energy over the year 1911 by 4,401 consumers, or 45 per cent., and its consumers of gas by a percentage at least as large. Applicant estimates an increase of 30 per cent. in its consumers for the year 1913."

PUBLIC UTILITY LECTURES IN NEW YORK.—A series of lectures on public utility matters is to be given at the West Side Branch of the Y. M. C. A., in New York city, under the auspices of its finance forum, and with the backing of leading financial interests in the field covered. The first was on March 9th, when Mr. T. C. Martin, Secretary of the National Electric Light Association, spoke on the "Magnitude of the Electric Light, Power and Transportation Business." Other topics which it is expected to cover are: "Magnitude of the Gas Business," "Financial Requirements of Public Utilities," "Future of Public Regulation of Utilities," "Result of Regulation of Public Utilities in Wisconsin," "Public Utility Franchises and Economics," "Municipal Ownership of Public Utilities," "Progress of the Science of Lighting," "Industrial Application of Electricity," "Centralization of Power Supply," "The Public, the Investor and the Holding Company," and "Treatment of Public Utilities by the Public to Secure the Best and Cheapest Service."

The Market FOR GAS SECURITIES.

In the vernacular of the street there was "Nothing doing" in Consolidated gas, nor was liveliness shown in any other gas shares, for that matter. Notwithstanding the general supineness of the market, it is also a fact that gas share values suffered least in respect of quotations. Consolidated opened this morning (Friday) at 132 to 133½.

Brooklyn Union shows little, if any, change, although one would hardly expect to find it at a lower quotation than the ruling one, of 125 to 127.

The Cincinnati Gas and Electric's quarterly of 1¼ is payable the first prox., and the U. G. I.'s quarterly of 2 is payable the 15th prox. These shares are firmly held, and many shrewd investors are beyond a doubt waiting to hear something respecting a change in capitalization. Another bit of news is the filing by the American Gas Company of a notification that its corporate existence has been made perpetual, and its capital is to be increased from $7,500,000 to $15,000,000. These divedends are declared and payable: United Gas and Electric, semi-annual of 3, April 1; Columbus (O.) Gas and Fuel Company, 1¼ per cent., preferred, April 1; the Consolidated Company, of Baltimore, regular quarterly of 1½, on common, and 3 per cent. semi-annual, preferred, both payable April 1.

The Pacific Gas and Electric called for payment Wednesday week, $5,000,000 of its 6 per cent. collateral notes, due June 25th, at 100½, the price fixed in the option. The U. G. I.'s net profits for 1913 were equal to 13.46 per cent. on its outstanding stock. The sum of $790,500 was set to sinking fund and $2,240,371 was set to undivided profit account.

GAS STOCKS.

Quotations by George W. Close, Broker and Dealer in Gas Stocks.

115 BROADWAY, NEW YORK CITY.

MARCH 16.

☞ All communications will receive particular attention.

☞ The following quotations are based on the par value of $100 per share:

N. Y. City Companies.	*Capital.*	*Par.*	*Bid.*	*Asked*
Consolidated Gas Co.	$99,816,500	100	132	133½
Central Union Gas Co.—				
1st 5's, due 1927, J. & J.	8,500,000	1,000	101	103
Equitable Gas Light Co.—				
Con. 5's, due 1932, M. & S.	1,000,000	1,000	101	104
Mutual Gas Co.	8,600,000	100	157	157
New Amsterdam Gas Co.—				
1st Con. 5's, due 1948, J. & J.	11,000,000	1,000	99	101
New York & Richmond Gas				
Co. (Staten Island)	1,500,000	100	59	62
1st Mtg. Gold Bds. 5 p. ct.	1,500,000	—	98½	100½
New York and East River—				
1st 5's, due 1944, J. & J.	3,500,000	1,000	103	105
Con. 5's, due 1945, J. & J.	1,500,000	—	96	100
Northern Union—				
1st 5's, due 1927, J. & J.	1,250,000	1,000	100	102
Standard	5,000,000	100	102	104
Preferred	5,000,000	100	93	94
1st Mtg. 5's, due 1930, M. & N.	1,500,000	1,000	90	95
The Brooklyn Union	15,000,000	1,000	125	127
1st Con. 5's, due 1948, M. & N.	15,000,000	—	102	113
Yonkers	200,000	500	130	—
Out-of-Town Companies.				
Boston United Gas Co.—				
1st Series S. F. Trust	7,000,000	1,000	82	85
2d " " "	3,000,000	1,000	47½	50
Buffalo City Gas Co.	5,500,000	100	2	5
Bonds, 5's	5,250,000	1,000	59	60
Binghampton Gas Works	450,000	100	—	—
" 1st Mtg. 5's	500,000	1,000	97	100
Capital, Sacramento	500,000	50	—	35
Bonds (6's)	150,000	1,000	—	—
Chicago Gas Co. Guaranteed				
Gold Bonds	7,000,000	1,000	104	106¼
Consolidated Gas Co. of N. J.	1,000,000	100	15	—
Con. Mtg. 5's	978,000	1,000	94	96
Bonds	75,000	—	—	100
Consolidated, Baltimore	13,460,084		118¾	119
Mortgages, 5's	3,400,000	—		—
General Mortgage 4½	10,661,000	—		—
Con. Gas Co., Baltimore City, 4½	2,751,000	—		—
Cincinnati Gas and Electric Co.	20,500,000	100	67	69
Columbus (O.) Gas Co., 1st Mortgage Bonds	1,500,000	1,000	96	98
Columbus Gas Light & Fuel Company	1,682,750	100	65¾	66¼
Preferred	3,026,500	100	33	35¾
Detroit Gas Co., 5's	881,000	1,000	75	80
" Prior Lien 5's	5,612,000	1,000	97	100½
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1,000	—	101
Essex and Hudson Gas Co.	6,500,000	—	133	136
Fort Wayne	2,000,000	—	—	—
" Bonds	2,000,000	—	55	—
Grand Rapids Gas Light Co., 1st Mtg. 5's	1,350,000	1,000	100	101
Hartford	750,000	25	190	200
Laclede Gas Co., St. Louis.	10,000,000	100	96	97
Preferred	2,500,000	100	—	102½
Bonds	10,000,000	1,000	102½	103
Lafayette Gas Co., Ind.	1,000,000	100	—	60
Bonds	1,000,000	1,000	60	65
Louisville	2,570,000	50	120	130
Massachusetts Gas Companies, of Boston	25,000,000	100	93¾	93¾
Preferred	25,000,000	100	95	95½
Madison Gas and Electric Co.				
" 1st Mtg. 6's	400,000	1,000	106	
Montreal L. H.& P., Canada	9,000,000	100	224	225
Nashville Gas Light Co.	1,000,000	100	110	—
Newark, N. J., Con. Gas Co.	6,000,000	—	97	98
Bonds, 6's	6,000,000	—	127	128
New Haven Gas Co.	5,000,000	25	189	190
Peoples Gas Lt. & Coke Co., Chicago	25,000,000	100	*121¾	122¾
1st Mortgage	20,100,000	1,000	102	102½
2d "	2,500,000	1,000	104	—
Pacific Gas and Electric Co.	15,500,000	—	45¾	45¾
Rochester Gas & Electric Co.	2,150,000	50	88	—
Preferred	2,150,000	50	118	—
Consolidated 5's	2,000,000	—	104¾	105½
St. Paul Gas Light Co.	2,500,000	100	—	—
1st Mortgages, 6's	650,000	1,000	104	105
Extension, 6's	600,000	1,000	112¾	115
General Mortgage, 5's	3,447,000	1,000	94	96
United Gas Imp. Co.	55,502,960	50	168	169
Washington (D. C.) Gas Co.	1,600,000	200	440	442
Western Gas Co., Milwaukee	4,000,000	—	—	—